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THE SYSTEMS APPROACH AND PROJECT MANAGEMENT IN THE NAVAL LABORATORY

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NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

THE SYSTEMS APPROACH
AND
PROJECT MANAGEMENT IN THE NAVAL LABORATORY

by

James Victor Qurollo, Jr.
and
Johnny Lee Roberts

September 1974

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This study investigates current thinking on the systems approach to management and its applicability to the project manager as an individual in the Naval laboratory, specifically the Naval Electronics Laboratory Center (NELC) in San Diego, California. It looks at the NELC organization, management roles, conflicts, interfaces, problems and some procedures which are used by project managers in planning

Block #20 continued

and controlling.

The authors conclude that laboratory project managers can be more effective if they have some management orientation or philosophy, and that the management philosophy that best fits the laboratory environment is the systems approach.

The Systems Approach

and

Project Management in the Naval Laboratory

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ABSTRACT

This study investigates current thinking on the systems approach to management and its applicability to the project manager as an individual in the Naval laboratory, specifically the Naval Electronics Laboratory Center (NELC) in San Diego, California. It looks at the NELC organization, management roles, conflicts, interfaces, problems and some procedures which are used by project managers in planning and controlling.

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I. INTRODUCTION

A. THE PROBLEM

The Naval Electronics Laboratory Center in San Diego, California is one of seventeen Naval laboratories which conducts research and development projects. The projects within the laboratory are normally headed by a designated project manager who is responsible to both the project sponsor and the laboratory. The majority of these project managers have technical backgrounds and are technically oriented; they are engineers who have been thrust into a difficult job which requires both engineering and managerial talent. By background, experience and education they are skilled in the required technical areas but have generally not had to give much thought to managerial problems.

The problem faced by the laboratory project manager is first to recognize the importance of managerial skills, and then do something about acquiring those skills so he can perform more effectively. Whether these engineers should receive managerial training before they move from the laboratory bench to the position of project manager is no longer a question. Today, research and its applications are becoming more management intensive and all phases of the acquisition process are receiving detailed attention at every level in the Navy. An increased insistence on accountability and performance point to a need for a higher degree of management orientation.

In this paper, the management problems which the project manager must confront in the Naval laboratory environment and a view of management which can be used to cope with these problems will be presented.

B. THE HYPOTHESIS

Naval laboratory project managers in general are technically oriented, have technical backgrounds but are sometimes lacking in the management orientation which is important to the project manager. The transition from engineer to project manager requires some change of motivation, new skills must be learned and one's scope and view must be expanded. Senior managers often give little attention to these needs, for they made the transition from engineer or scientist to manager long ago and have outgrown the difficulties they felt at the time. The management training offered is often poorly related to the problems involved in project management and the new project manager is left to find his own way, sometimes at the project's and organization's expense.

Therefore, it is the hypothesis of this paper that the laboratory project manager needs some management orientation to successfully deal with the <u>management</u> problems inherent in a project. This does not mean to imply that his technical orientation is any less important or that technical skills should suffer because he develops a management philosophy. The authors believe that for a project manager to effectively manage a project, he needs a management orientation

to compliment his technical ability. In addition, the management orientation or philosophy which he should use is the systems approach to management. He cannot walk around in a world of his own but must realize that "everything depends on everything else."[1]

C. THE APPROACH

The purpose of the investigations and research conducted was to examine the techniques of control and management used by project managers in a Naval laboratory and determine the organizational structure and procedures which form the basis of the laboratory's working relationships. In addition, various articles and books were researched to confirm the authors' thoughts as to what constitutes the total systems approach to management.

The approach to this study consisted of three basic phases. The first phase involved three visits to NELC at San Diego to conduct interviews with project managers, research engineers, operations analysts, contracting specialists, contracting officers and a project manager outside NELC.[2] This phase also included one visit to the Naval Weapons Center, China Lake, California in an effort to discover problems and techniques common to project managers

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[1]Cleland, D. I. and King, W. R., Management: A Systems Approach, p. 142, McGraw-Hill, 1972.

[2]An interview was conducted with Mr. John Heising, Viking Program Manager for Teledyne Ryan in San Diego, to obtain a feeling for some procedures and techniques used by a non-laboratory project manager.

in both NELC and NWC through interviews with personnel in positions similar to those interviewed earlier. Over a six month period, a total of nineteen interviews were conducted and the laboratory/project organization and procedures were reviewed in depth.

The second phase of the approach involved primarily library research into the theory of the systems approach to management. The current thought and direction of the systems theory was reviewed along with its application in various organizations. The timing of this phase overlapped the other two phases and a portion of it was accomplished between visits to the laboratories.

The third phase was the main thrust of this paper and consisted of an application of the systems approach to the laboratory project manager's environment through an analysis of the data obtained.

II. THE SYSTEMS APPROACH TO MANAGEMENT

A. INTRODUCTION

This chapter will discuss the concept of a systems approach to management. The application of the systems approach to project management in a Naval laboratory will be discussed in Chapter IV.

In current writings on the subject of total systems approach, there is no obvious agreement as to the meaning of "total systems." Some authors contend that while a total systems approach is theoretically possible, practically speaking it is not feasible.[3] Other authors believe that the key utility of the systems viewpoint is not in its academic value, but rather its applicability to the real world.[4] There are some indications that the term "total systems approach" is used rather loosely and with little consistency as to its meaning. Therefore, it seems appropriate at this time to provide an understanding of the term which will fit with the concept and application as intended for this paper.

B. THEORETICAL ASPECTS

Before "systems approach" is discussed, an understanding of the various meanings of the word system should be presented.

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[3]Brooker, W. M. A., "The Total Systems Myth," in Emerging Concepts in Management, ed. by Wortman, M. S., Jr. and Luthans, F., pp. 362-370, Macmillan, 1969.

[4]Cleland, *op. cit.*, p. 146.

The Dictionary defines system as:

> ...1. a set or arrangement of things so related or connected as to form a unitary or organic whole: as, a solar <u>system</u>, irrigation <u>system</u>, supply <u>system</u>. 2. the world or universe. 3. the body considered as a functioning organism: as, my <u>system</u> needs toning up. 4. a set of facts, principles, rules, etc. classified or arranged in a regular, orderly form so as to show a logical plan linking the various parts. 5. a method or plan of classification. 6. a regular, orderly way of doing something; order; method; regularity. 7. a number of bodily organs acting together to perform one of the main bodily functions: as, the circulatory <u>system</u>, digestive <u>system</u>. 8. an arrangement of rocks showing evidence, as through fossils, of having been formed during a given geological period: as, the Devonian <u>system</u>. 9. a group of transportation lines under a common owner. 10. in chemistry, a group of substances in or approaching equilibrium: a system with two components is called binary, one with three, ternary, etc....[5]

There appears to be as many definitions of system as there are texts written on the systems approach. As one text on systems theory and management states:

> The concept of a "system" is getting a great deal of attention in both industrial and academic circles. Unfortunately, the word has many meanings; for purposes of this discussion, a system is simply an assemblage or combination of things or parts forming a complex whole. One of its most important characteristics is that it is composed of a hierarchy of subsystems.[6]

Some of the earlier and more influential (judging from the number of times they are referenced in readings on system theory) proponents of the systems approach, Johnson, Kast

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[5] <u>Webster's New World Dictionary of the American Language, College Edition</u>, ed. by Guralnik, D. B. and Friend, J. H., pp. 1480-81, World Publishing, 1964.

[6] Martin, E. W., Jr., "The Systems Concept," in <u>Systems, Organizations, Analysis, Management: A Book of Readings</u>, ed. by Cleland, D. I. and King, W. R., pp. 49-50, McGraw-Hill, 1969.

and Rosenzweig, define a system initially as:

> ..."an organized or complex whole, an assemblage or combination of things or parts forming a complex or unitary whole." The term system covers an extremely broad spectrum of concepts.[7]

and later as:

> ...an array of components designed to accomplish a particular objective according to plan. There are three significant points to this definition. First, there must be a purpose, or objective, which the system is designed to perform. Second, there must be a design or an established arrangement of the components. Finally, inputs of information, energy, and materials must be allocated according to plan.[8]

Melvin B. Kline and Melvin W. Lifson, in lecture notes prepared for a System Engineering course at the University of California, Los Angeles, define a system as follows:

> A system is a set of elements organized to perform a set of designated functions in order to achieve desired results. An element is a set of resources organized to perform some highly interrelated subset of the desired system functions. The resources which comprise an element include personnel, material, equipment, facilities, and information.[9]

There are many more definitions of a system which could be presented. However, the definitions we have chosen to include appear to have a common set of ideas throughout. They can be construed to include the assemblage or arrangement of parts, things, components or elements organized into

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[7]Johnson, R. A., Kast, F. E., and Rosenzweig, J. E., The Theory and Management of Systems, p. 4, McGraw-Hill, 1963.

[8]*Ibid.*, p. 91.

[9]Kline, M. B. and Lifson, M. W., System Engineering, p. 1-14, Lecture Notes, 1970.

a complex, unitary whole or structure. Therefore, for purposes of this paper, a system can be defined to include the interaction, interdependency and integration of the combination of elements into a unitary whole by means of a plan to achieve desired results. Obviously, the meaning or concept of the word "system" carries with it a much greater amount of thought and in-depth study than is generally realized.

An application of a system which will be used in this paper is seen in the Naval laboratory organization which can be viewed as a man-made system having interaction with its environment (i.e. sponsor, contractor, workcenters, specialists, other government agencies, etc.). It is a system of interrelated parts working in conjunction with each other in order to accomplish desired results, both of the organization and the individuals.

Now that the term "system" has been defined and it is understood how it will be used in this paper, what is the systems approach to management or the systems concept? The systems concept is more widely discussed than understood. It has been widely applied by people who did not know they were doing so and has often been ignored by people who should know better.[10]

The systems approach primarily involves the idea that every organization is a system and is composed of many interrelated parts, all of which affect each other and the

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[10] Cleland, D. I. and King, W. R., Systems, Organizations, Analysis, Management: A Book of Readings, p. 47, McGraw-Hill, 1969.

total system in some manner. Therefore, a manager's main concern should be given to the overall effectiveness of the system (rather than to the effectiveness of the individual parts or subsystems) and to the inter-dependencies of the elements of the system. This concept can be applied to any organization and any level in an organization. In applying the systems approach, overall organizational objectives and goals must be considered rather than just considering the parochial objectives of a particular subsystem. The manager must consider overall objectives and, if necessary, make decisions which are sometimes non-optimal for his subsystem.[11] This does not imply that subsystems will always be non-optimized, for some decisions which are optimal for the total system will also be optimal for the subsystem.

The theory of systems concepts closely relates to a general theory of management that has evolved. It focuses on the fundamental processes which are essential for any type of organization — business, government, educational, social and other activities — where human and physical resources are combined to meet certain objectives.[12] These fundamental processes have been described in various ways, but the four basic functions of planning, organizing, controlling and communicating have received general acceptance.

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[11] *Ibid.*

[12] Johnson, *op. cit.*, p. 14.

Richard Johnson, *et. al.*, defines them in terms of systems concepts as follows:

> Planning. The managerial function of planning is one of selecting the organizational objectives and the policies, programs, procedures, and methods for achieving them. The planning function is essentially one of providing a framework for integrated decision making and is vital to every man-machine system.
> Organizing. The organizing function helps to coordinate people and resources into a system so that the activities they perform lead to the accomplishment of system goals. This managerial function involves the determination of the activities required to achieve the objectives of the enterprise, the departmentation of these activities, and the assignment of authority and responsibility for their performance. Thus the organizing function provides the inter-connection, or intertie, between the various subsystems and the total organizational system.
> Control. The managerial function of control is essentially that of assuring that the various organizational subsystems are performing in conformance to plans. Control is essentially the measurement and correction of activity of the subsystems to assure the accomplishment of the overall plan.
> Communication. The communication function is primarily one of the transfer of information among decision centers in the various subsystems throughout the organization. The communication function also includes the interchange of information with the environmental forces.[13]

These four functions should not be considered as independent activities nor should any time sequence be implied. It is part of the systems concept to realize how interlocked they are. Another list of the functions of management is planning, organizing, staffing, directing and controlling.[14] Whatever terms are used, the advantage of approaching any

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[13] *Ibid.*, pp. 14-15.

[14] Koontz, H. and O'Donnell, C., Principles of Management: An Analysis of Managerial Functions, pp. 47-49, McGraw-Hill, 1972.

area or problem as a system so the critical variables and constraints and their interaction with each other can be seen is obvious. "It forces scholars and practitioners in the field to be constantly aware that one single element, phenomenon, or problem should not be treated without regard for its interacting consequences with other elements."[15] This is exemplified in the case of the four managerial functions or processes.

The planning, organizing, controlling and communicating functions form the structure, means, measure and environment of the decision-making process. Management is basically the coordination and integration of all resources (both human and technical) to accomplish specific results.[16] The total management process includes coordinating the functions so as to meet the overall objectives of the system. Therefore, the systems approach also involves coordinating and integrating the management functions of planning, organizing, controlling and communicating in a systematic manner.

C. CURRENT THOUGHTS ON THE SYSTEMS APPROACH

The systems concept has been in existence for many years; but in the past decade, a general systems theory has

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[15] *Ibid.*, p. 14.

[16] Scanlan, B. K., Principles of Management and Organizational Behavior, p. 5, John Wiley & Sons, 1973.

been developed to provide a basis for the integration of managerial techniques and scientific knowledge across a broad spectrum.

In one of the more current texts on the systems concept, Edgar Huse and James Bowditch address the subject from three perspectives — the structural-design view of management, work flow and the human perspective.[17] Regardless of the perspective, the organization is treated as an open system[18] which affects and is affected by its environment. The inter-dependencies among the subsystems are as important as the individual subsystem. Organizations try to achieve a balance among the subsystems, but the balance is continually changing with the need to adapt to an unstable environment and the inter-dependence of the parts. The organization must be viewed from all three perspectives (as formal organizations, as flow systems and as interacting humans) for a complete understanding. To use the systems approach, it is necessary to integrate these perspectives.[19]

Another view of the systems concept which is more engineering/problem solving oriented is in the field of systems engineering.

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[17] Huse, E. F. and Bowditch, J. L., Behavior in Organizational Behavior, p. 5, John Wiley & Sons, 1973.

[18] A system is an "open system" when there are constant relationships to its environment, or inputs from the environment and outputs to the environment.

[19] Huse, *op. cit.*, pp. 44-45.

> Experience has shown that the successful planning and acquisition of large complex systems requires the "systems approach." The systems approach recognizes the interrelationships which tie a system together; it recognizes that factoring out a part of a problem by neglecting the interactions among subsystems and components increases significantly the probability that a solution to the problem will not be found; it requires that the boundaries of the system be extended outward as far as is required to determine which interrelationships are significant to the solution of the problem.[20]

This systems engineering view was generated in part by inadequacies of military system acquisition and operation and considers systems engineering as the application of the systems approach.[21] In this paper, a broader view of the systems approach is taken and it is considered as more of a management philosophy than a problem solving or engineering technique.

Another view, presented by Richard Johnson, *et. al.*, of the systems concept is to describe the flow process, analyze each segment and explore relationships of parts to the whole. In this way, subsystems which fail to optimize their contribution to the total system can be recognized.[22] This view thinks of the organization as an integrated whole where each subsystem or part is associated with the total operation and its structure is created by many subsystems

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[20]Kline, *op. cit.*, p. 1-12.

[21]*Ibid.*, p. 1-13.

[22]Johnson, *op. cit.*, p. 90.

arranged in hierarchial order. The output of the lower subsystems is input for higher subsystems, which is input for the next higher level, etc.[23]

In this paper, the systems concept is viewed as a useful way of thinking about the job of managing. It provides a framework for visualizing environmental factors and allows recognition of the functions of subsystems. Systems in which managers function are complex and the systems concept fosters a way of thinking which helps clear up some of the complexity while at the same time helps the manager recognize the nature of complex problems so he can better operate within the system.[24] It is important to recognize that every organizational system is part of a larger system with which it interacts and influences, and that all systems are in a constant state of change — they are created, operated, revised and sometimes eliminated.[25]

D. THE TOTAL SYSTEM APPROACH

The "total system approach" is basically a philosophy or concept of management. The management can involve systems engineering, business management, developmental engineering or project management, to name a few. Regardless

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[23]*Ibid.*, p. 91.

[24]Johnson, R. A., Kast, F. E. and Rosenzweig, J. E., "Systems Theory and Management," in Emerging Concepts in Management, ed. by Wortman, M. S., Jr. and Luthans, F., p. 331, Macmillan, 1969.

[25]*Ibid.*

of the area or discipline in which it is used, it is a way of thinking or philosophy for a manager rather than a list of techniques, principles, "recipe book" or body of knowledge.

It is a concept which provides the manager with a framework he should use to visualize the system in which he operates and the manner in which his area of responsibility is constrained and influenced. It recognizes the systems concept and the complex interrelationships which exist in every organization of subsystems. If understood by the manager, it will help to remove some of the complexity of his job on the one hand; and on the other, help him to recognize the very complex nature of the structure within which he works.

Some authors have implied that the concept of "general systems" has been translated into "total systems." While general systems theory is a valid concept because its proponents realize its limitations, the total systems concept is not valid because it cannot explain the way things are or predict the way things are going to be (regarding the most significant aspect of the organization, people).[26] However, the meaning of the term "total system" as used here is not intended to imply a specific systems analysis technique or management information system which will solve all

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[26]Brooker, *op. cit.*, p. 365.

the problems which a manager encounters or predict problems which will arise. Rather, total system implies a management <u>outlook</u> which is oriented toward the goals and objectives that have been established for the <u>whole</u> or <u>total system</u>.

To use the total system approach, the manager must be able to see beyond the immediate consequences of any decision or change which he makes in his subsystem of the organization. No one subsystem of an organization can function effectively without others and any action taken by one will have effects which can be traced throughout the total system.[27] When a manager makes a decision with no thought of its effect on other parts of the organization or the organization as a whole, he is not using the total system approach as viewed here.

In the following chapter, the Naval Electronics Laboratory Center's mission, personnel, funding, organization, manager roles, conflicts and interfaces will be presented in order to gain a clearer understanding of why and how the system approach might be used by laboratory project managers. Chapter IV presents the history of project management, NELC project management, NELC project manager's profile, some examples of problems encountered in planning and controlling and examples of use/nonuse of the systems approach. Throughout the discussion which follows, the systems concept,

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[27]Cleland, <u>Management</u>, p. 142.

or making decisions (whether planning or control decisions) in the light of their effect on other subsystems in the organization, must be kept in mind. Understanding the complexity of the Naval laboratory, the many interfaces with which the project manager must deal and some of the problems encountered should make the value of the systems approach to management clear.

III. THE NAVAL ELECTRONICS LABORATORY CENTER

A. INTRODUCTION

Government laboratories can trace their history to the establishment of the Springfield Arsenal in 1790. Over the years Naval laboratories have played a major role in the development of weapons systems and have been responsible for technological advances in many areas.[28]

Today, the prime mission of the Naval Electronics Laboratory Center (NELC) is to be the principle Navy Research, Development, Test and Evaluation center for electronics technology and command, control and communication concepts and systems. More specifically, it is the primary in-house research and development capability for the following:

- Navy and Marine Corps systems, subsystems and technologies
- command, control and communications
- electromagnetic surveillance, identification and navigation
- electronic warfare
- shipboard internal communications
- information collection, processing, transmission and display
- computer and software technology
- automatic test and monitoring equipment

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[28]For a complete treatment of Naval laboratory history see Munro, W. S. and Brennan, A. C., Project Management as Related to Weapons Development in Navy Research and Development Organizations, Master's Thesis, Naval Postgraduate School, Monterey, California, 1973.

- electro-optics and optics
- electronic materials, components and circuits
- electromagnetic propagation
- antennas and antenna systems
- human factors technology
- electronic systems effectiveness engineering
- bioelectronics.

The Naval Electronics Laboratory includes over eighty military personnel and fifteen hundred civilian personnel. More than three hundred of these hold advanced degrees and the proportion of advanced degrees has increased over the years. (Figure 1 gives an NELC educational profile from fiscal year 69 through 74.) Approximately one-half of all NELC personnel are professionals. Figure 2 gives examples of NELC professionals along with its professional mix.

The laboratory is under the Navy Industrial Funding System and operates much like an individual business enterprise, with complete accountability to its customer and Navy fiscal management. All funds, with few exceptions, are received from sponsors as the result of successful project bidding in competition with other research and development organizations. The exceptions are military construction funds and a small amount of equipment and minor construction and repair funds provided by the Director of Laboratory Programs. The laboratory fiscal 73 budget, for example,

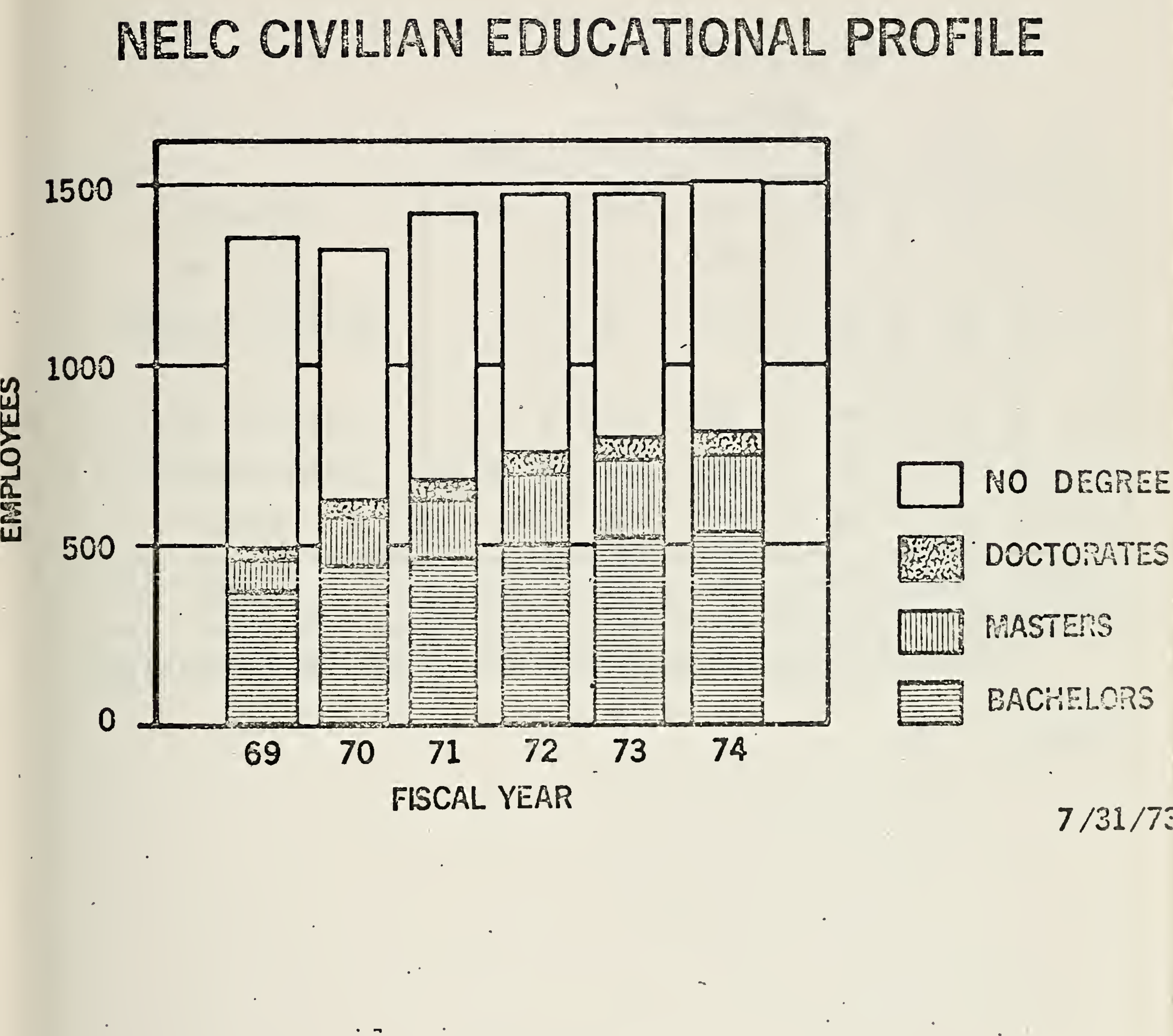
NELC CIVILIAN EDUCATIONAL PROFILE
EMPLOYEES
1500
1000
500
0
69
70
71
72
73
74
FISCAL YEAR
NO DEGREE
DOCTORATES
MASTERS
BACHELORS
7/31/73

Figure 1.

NELC PROFESSIONALS MIX*

	FISCAL YEAR 69	70	71	72	73	74
ENGINEERS	342	403	456	495	511	530
PHYSICISTS	70	99	108	114	112	111
OPERATIONS RESEARCH ANALYSTS	21	31	32	33	36	38
PSYCHOLOGISTS	17	17	18	20	19	19
MATHEMATICIANS	40	51	53	42	31	30
OTHER	9	20	25	24	27	28
TOTALS	499	621	692	728	736	756

*CSC DEFINITION EXCLUDES CERTAIN PROFESSIONALS IN COMPUTER SCIENCES

9/30/73

Figure 2.

totaled over $123 million. Figure 3 shows the history of NELC funding by RDT&E categories.[29]

To aid in understanding the role played by the laboratory project manager in equipment acquisition, this chapter presents the NELC organization, manager roles, conflicts and interfaces.

B. ORGANIZATION

The traditional method of organizing has been functional departmentalization. This method utilizes a top-to-bottom model with departments such as engineering, administrative support, etc. responsible to one manager. However, if the emphasis in an organization is on contract work where the workload is composed of various projects with specific objectives and well-defined points of completion, then project organization is more appropriate.[30]

NELC has need for both the functional and the project organizational models and therefore operates within a matrix organization (Figure 4). "The matrix organization is the realization of a two-dimensional organization which emanates directly from the two dimensions of authority. Two complementary organizations — the project organization and the functional organization — are merged to create the

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[29] Naval Electronics Laboratory Center Digest, prepared by NELC Planning Office, 30 June 1973.

[30] Cleland, Management, p. 337.

HISTORY OF NELC FUNDING BY RDT&E CATEGORIES

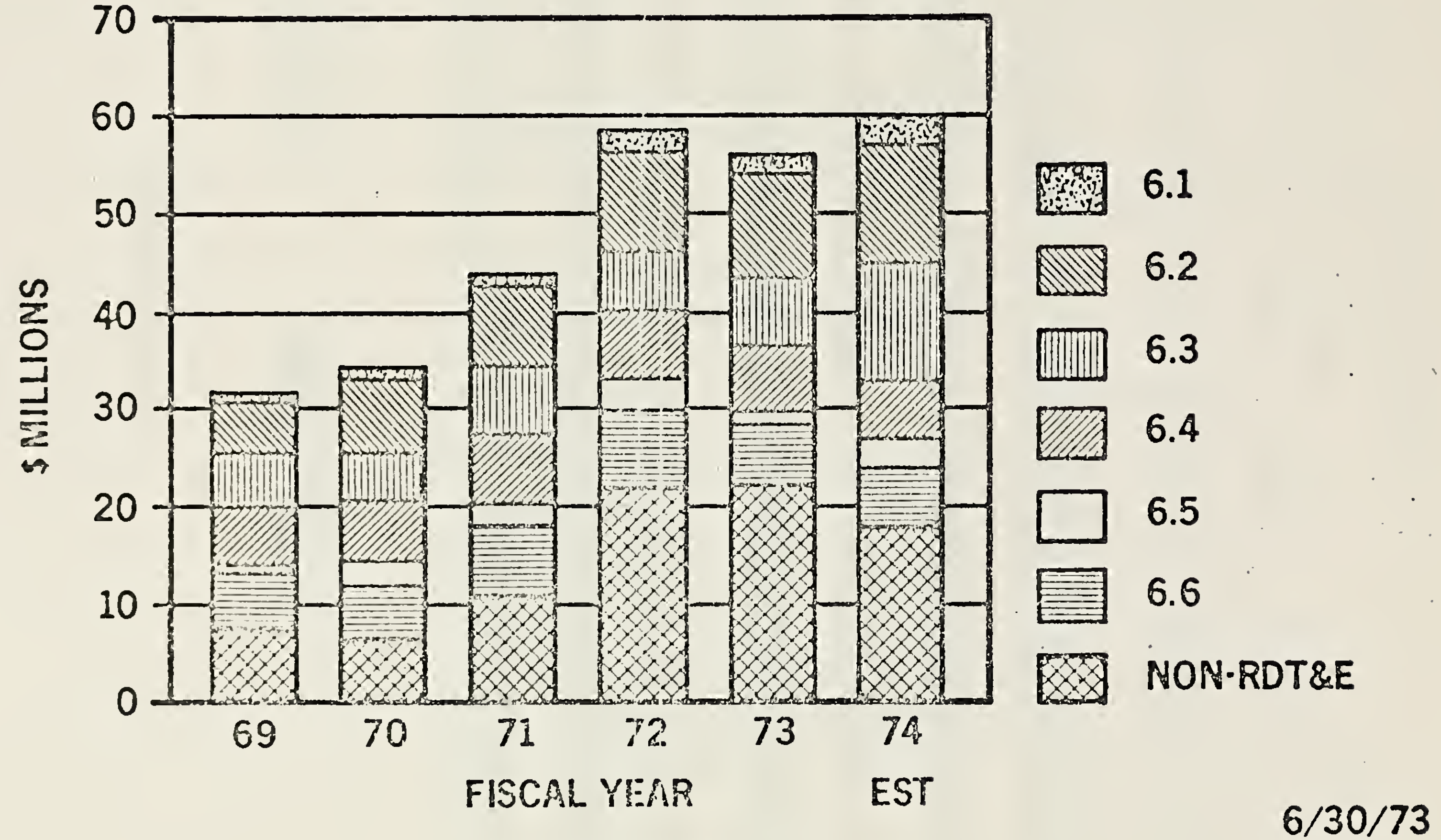
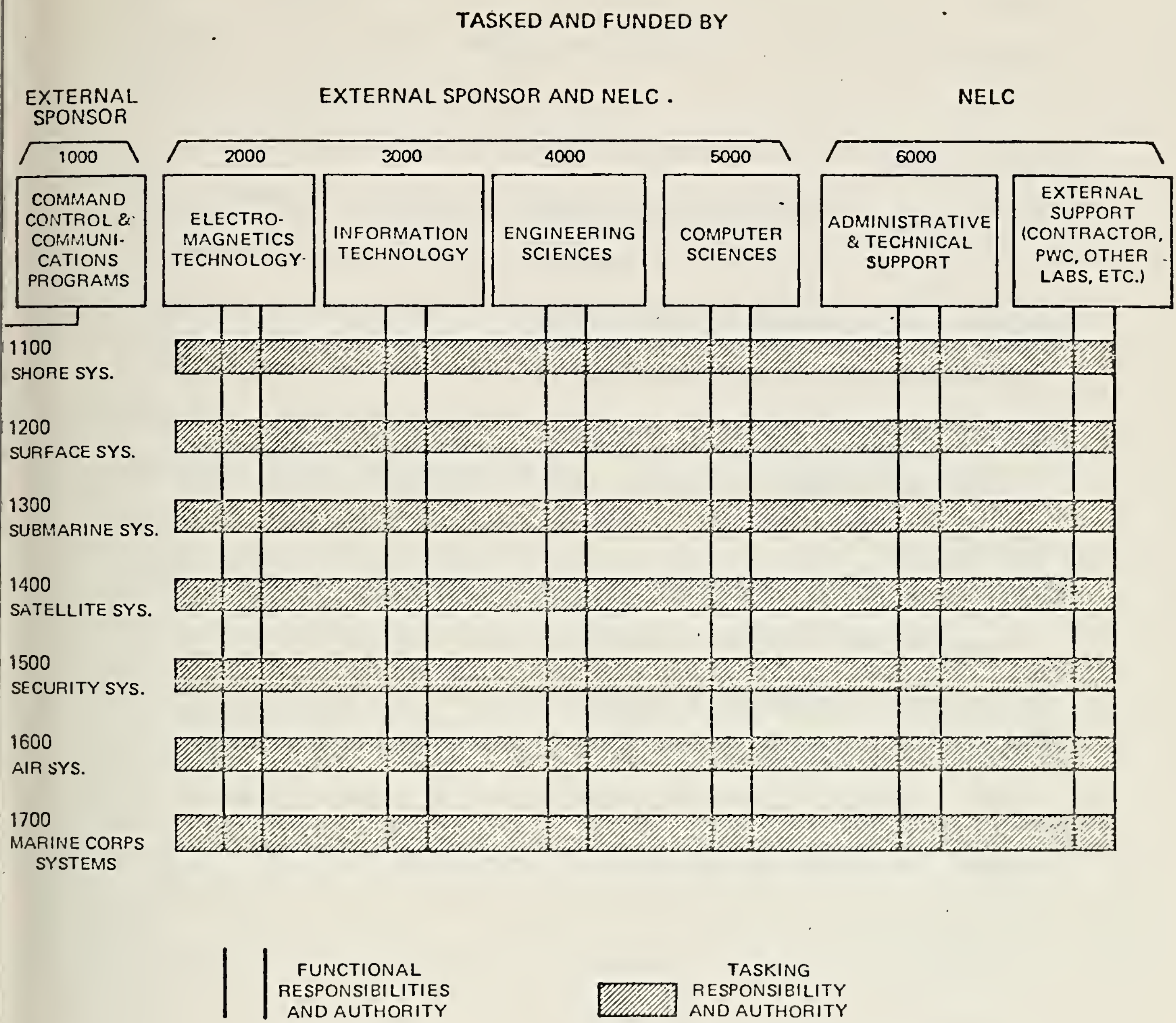


Figure 3.



NELC Matrix organization

Figure 4.

matrix organization."[31] This type organization is ideally suited as the NELC operating structure, for NELC is basically two dimensional.

The Command Control and Communications Program Department (Figure 5) contains seven major programs (e.g. Shore Systems - 1100, Surface Systems - 1200, etc.) which are externally sponsored.[32] Each major program in the Command Control and Communications Department contains numerous smaller projects (e.g. World Wide Military Command Control System - 1130 under the Shore Systems Program and the Minimum Essential Emergency Communication Network Project - 1320 under the Submarine Systems Program) which are headed by a project manager. The projects within the Command Control and Communications Program Department comprise approximately one-half of all NELC projects and are tasked and funded primarily by the Naval Systems Commands. The projects in turn task and fund the five functional departments (along with some outside contractors and other laboratories) for a specific requirement or level of effort. The project offices are organized functionally and may contain only a few code 1000 personnel who are primarily responsible for managing the overall project. An example of a Command Control and Communications Programs Department

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[31] *Ibid.*, p. 339.

[32] For purposes of this paper "externally sponsored" refers to any project which is funded directly from a source outside the laboratory organization.

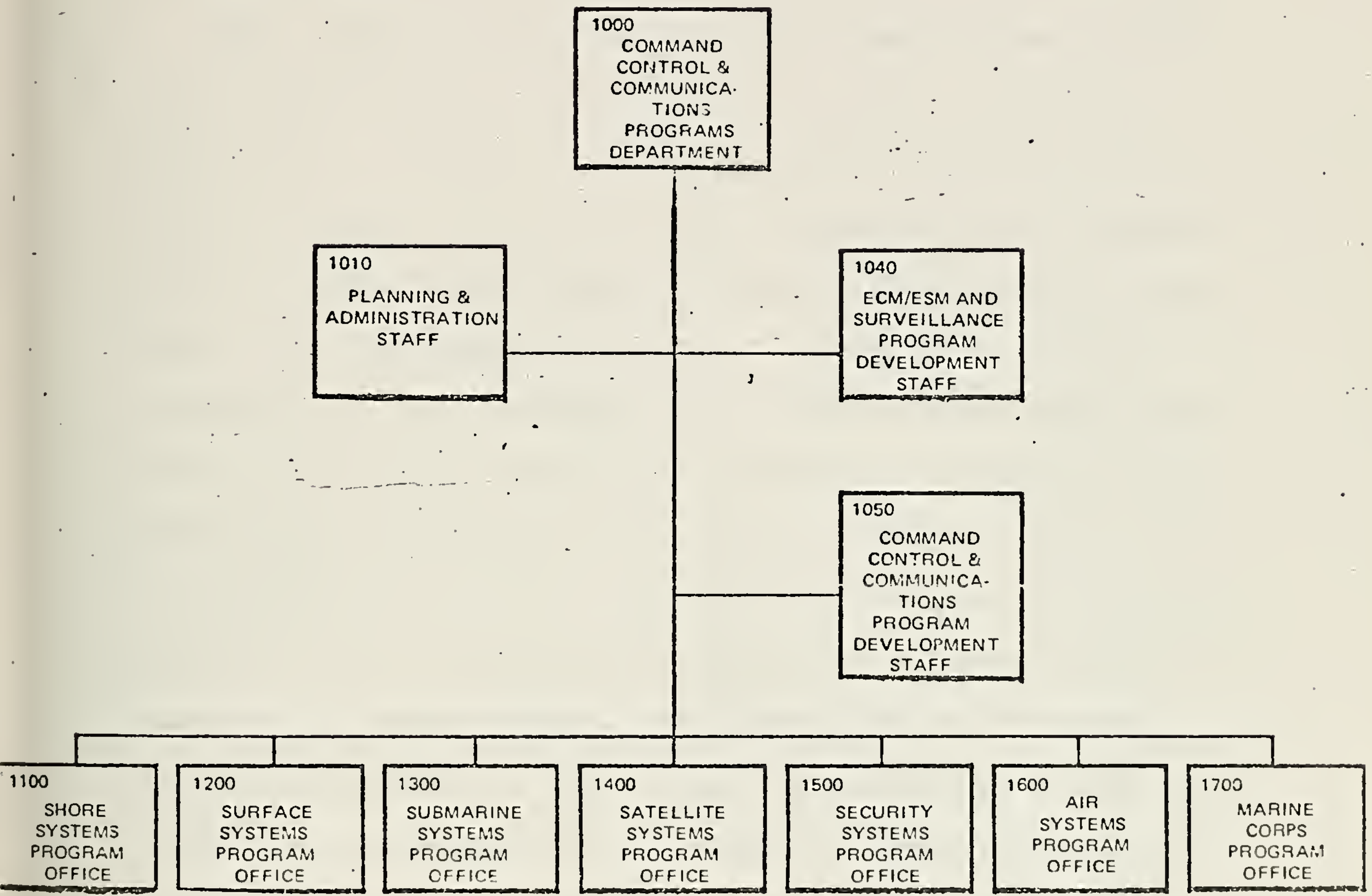


Figure 5. Command Control and Communications Programs Department Organization.

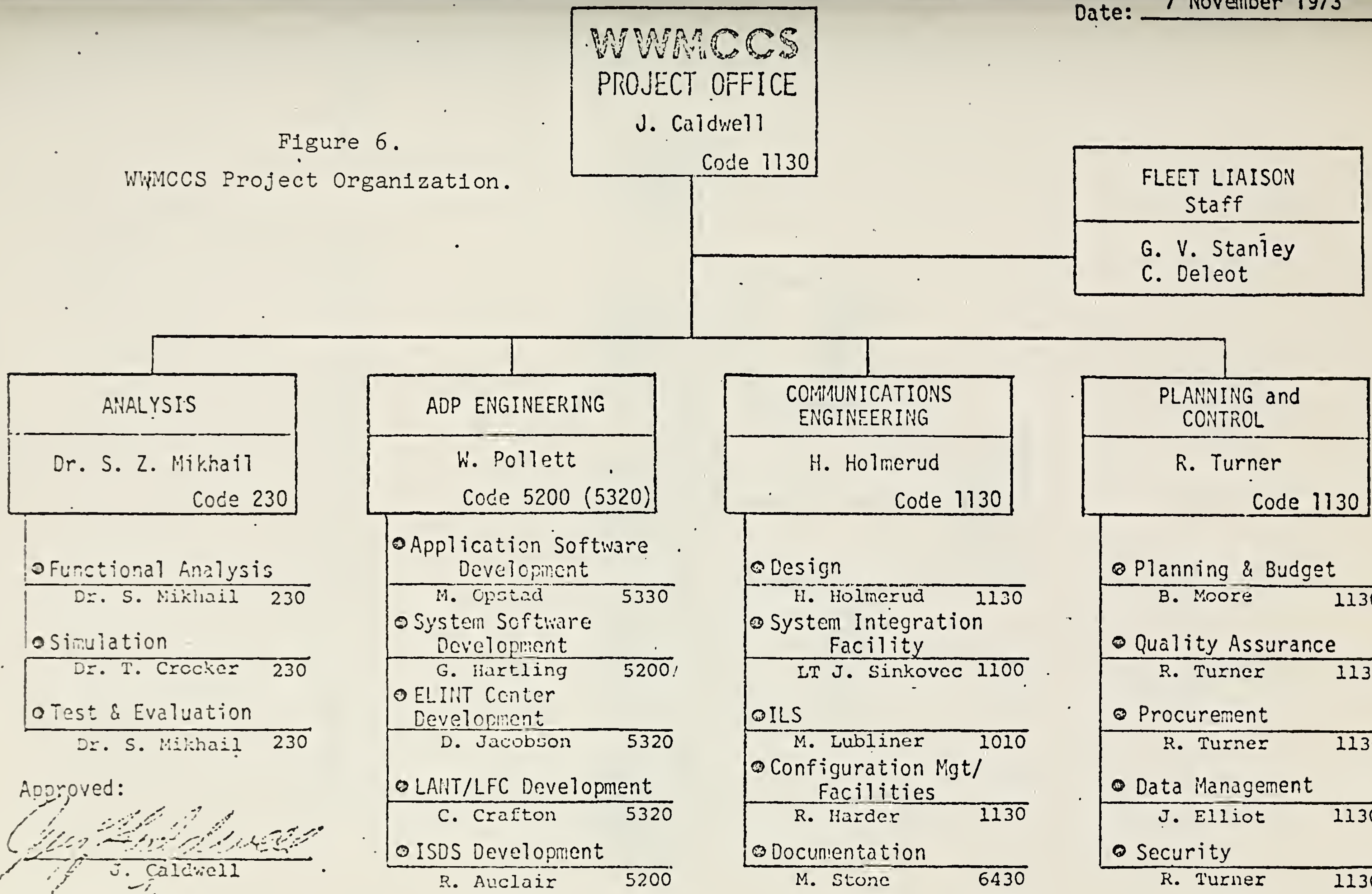
project is the World Wide Military Command Control System (WWMCCS) project organization depicted in Figure 6. The project organization of the Command Control and Communications Programs Department is the first dimension of the two-dimensional matrix organization.

The second dimension of the NELC organization is seen in the five functional departments of Electromagnetics Technology, Information Technology, Engineering Sciences, Computer Sciences and Administrative and Technical Support. Each functional department is further organized into functional areas of specialization and appropriate staffs (Figure 7). The technology and sciences departments maintain some of their own projects which are externally sponsored while at the same time acting as primary support for the Command Control and Communications Programs Department projects. When a functional department is performing a task for a Command Control and Communications Programs Department project, a task leader is designated within the functional department and has primary responsibility for the completion of the required task or level of effort. The task leader maintains close contact with the project manager through frequent conversations and weekly milestone/project review meetings. When a functional department has externally sponsored projects, a project manager is designated within the department and has control of the entire project.

Date: 7 November 1973

Figure 6.

WWMCCS Project Organization.



Approved:

J. Caldwell

R. Turner

Submitted: ______ ______

(Date)

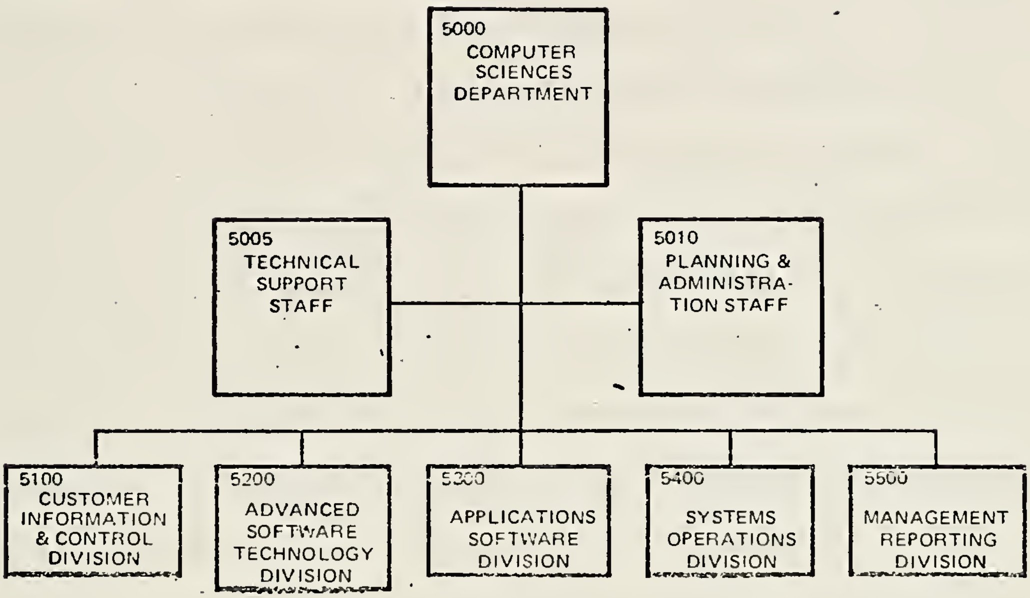


Figure 7. Typical Functional Department Organization.

C. MANAGEMENT ROLES AND THE SYSTEMS APPROACH

1. Functional Managers

The functional manager and project manager have different views of the organization. The functional manager is primarily responsible for a particular function or technology within the organization and for providing information and skills on the "state-of-the-art" in his discipline. In addition, he must support projects in the organization which require his knowledge and skill. However, he is not responsible to the project office for performance but is responsible through the chain of command for his particular department or subsystem within his department. Consequently, it is natural for him to become parochial in his viewpoint. If not carried to an extreme, this is a desirable situation for it tends to protect the integrity of existing specialized areas. The functional manager may however, become so wrapped up in his own area of specialization that he comes to consider his function as the only important one — at the expense of other parts of the organization or overall organizational objectives.

> In the very human desire to do a good job, the functional manager tends to develop "tunnel vision," which allows him to see things only within the narrow scope of his function and to conveniently ignore the "bigger picture"...An often-heard gripe in a variety of different organizations is that the organization seems to be run for the benefit of the accounting department or the elevator operators rather than to enhance the opportunity to achieve overall objectives. This is a natural out-growth of over-zealous functional management. Since

> the responsibilities of the functional manager are limited to his area, he seeks to make that area as efficient and effective as possible — often without regard to the effect of his actions on other functions or, more importantly, on the basic tasks which the overall organization must perform.[33]

Although this loss of the "big picture" or not using the systems approach may become a problem in functional department management, it is not as critical a situation for the functional manager as it is for the project manager.

2. Project Managers

The project manager is truly a general manager. He must have the "big picture" and view his project and the organization in a perspective which will allow him to consider the performance, cost and schedule aspects of his project. At the same time he must motivate diverse groups toward a common goal or objective for his project while keeping in mind the goals of the total system. Although the project manager normally operates at a relatively low level in the NELC organization (i.e. fifth level below the Technical Director) "he must perform the same general management functions as do top managers — he must integrate the efforts of a variety of functional managers to accomplish the goals of the project and the organization."[34] He must have a basic understanding of all the functional

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[33]Cleland, Management, pp. 340-341.

[34]*Ibid.*, p. 342.

areas and realize the importance of each in the accomplishment of overall objectives. If he gets "tunnel vision" and the attitude that all other projects and functions are less important than his own, he may be in a position to upgrade his project at the expense of others and possibly at the expense of the total system. The project manager must use the systems approach.

D. MANAGEMENT CONFLICT

Conflict between the functional manager and the project manager is a natural outgrowth of the matrix organization. The project and functional managers maintain a relationship similar to a buyer/seller relationship with their respective organizational elements having conflicting objectives. The project manager's first objective is to obtain satisfactory performance and schedule at the lowest possible cost to the project. The functional manager naturally wants what is best for his particular subsystem within the organization and must divide his resources among various projects. "The project and functional managers are thereby involved in a deliberate and purposeful conflict within the organization."[35]

If both managers use the systems approach or think in terms of the total system, this conflict is beneficial to the objectives of the organization as a whole. The project

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[35] *Ibid.*

and functional manager must understand each others problems, constraints, goals and objectives in order to maintain an atmosphere of cooperation and compromise. If however, the manager views his subsystems as the only important one and always works to optimize its objectives, conflicts will increase and may need to be resolved at a common supervisor level in the organization. For example, at NELC if the WWMCCS Project Manager and a functional manager in the Application Software Division of the Computer Sciences Department could not reach agreement as to which engineer was to be assigned to work on the WWMCCS Project, theoretically, the lowest common supervisor at which the conflict could be resolved would be the Technical Director (Figure 8). In practice, this would probably not happen for the conflict would be resolved at a lower level (i.e. the project manager's superior and the functional manager's superior might discuss the problem, make a decision and pass it down to the project and functional managers without allowing the conflict to go any higher in the organization).

Other conflicts arise involving promotion of personnel, personnel tasking, resource allocation and priorities. When these conflicts develop, a willingness on the part of the functional and project managers to negotiate is essential to the proper functioning of the matrix organization. These problems are further developed in Chapter IV.

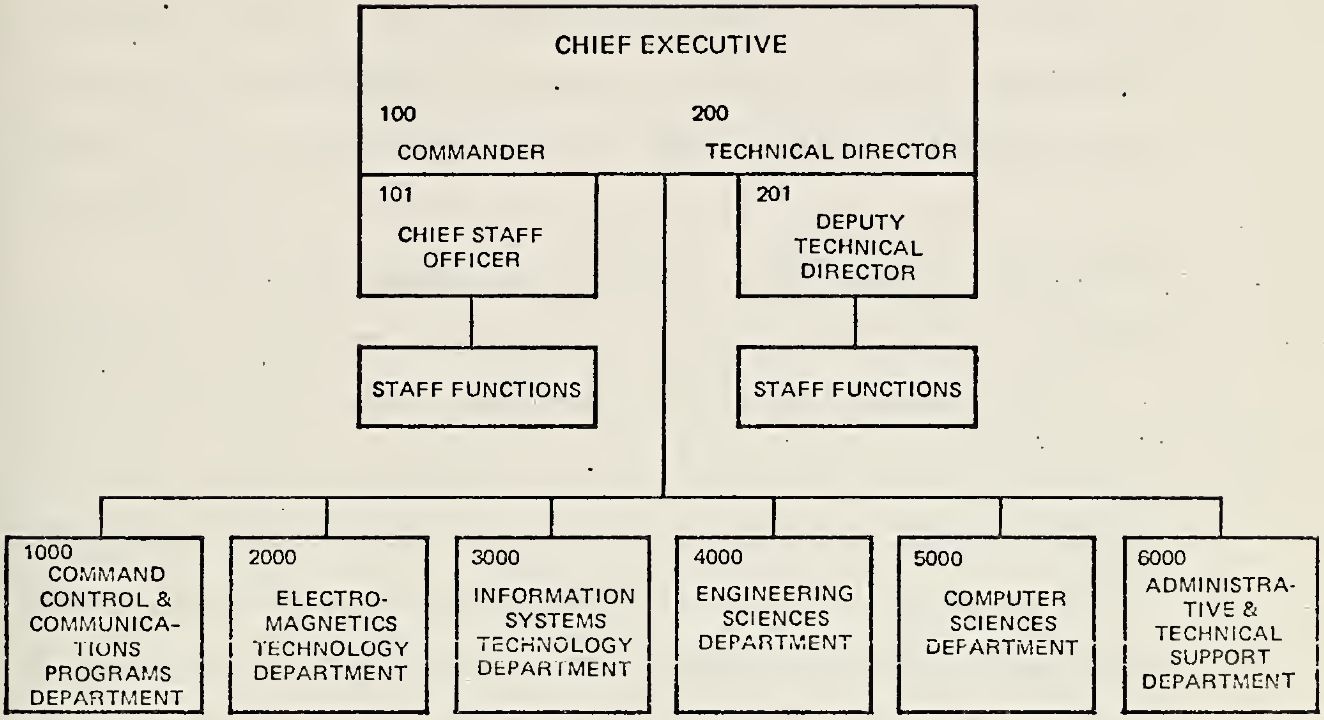


Figure 8. NELC Organization.

E. INTERFACES

1. External Interfaces

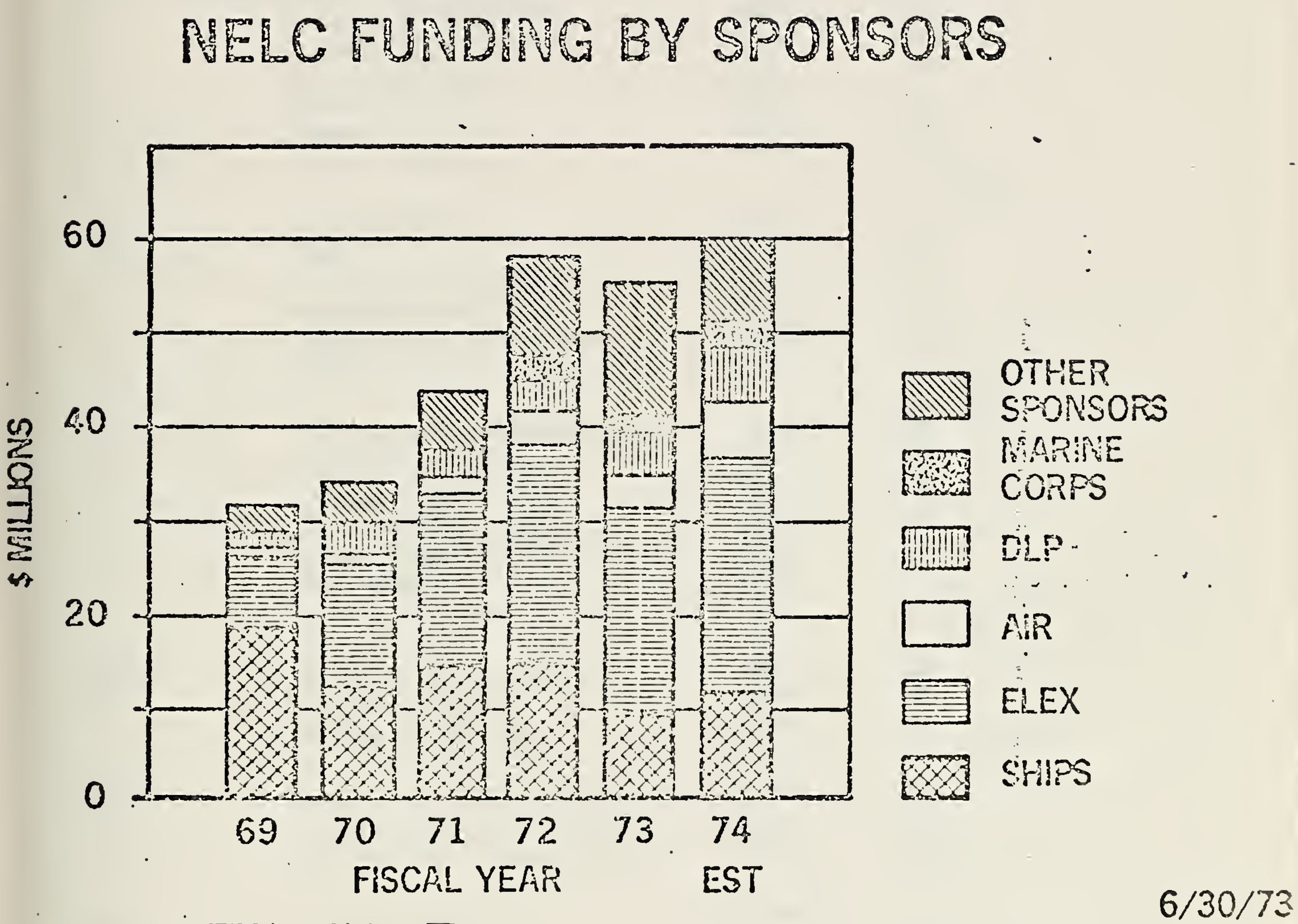
The range of external interfaces which are required by NELC in day to day operations is much too wide and varied to investigate in detail. However, some interfaces which are the most pertinent to NELC project managers will be presented.

The most important external interface for NELC and individual project managers are with Naval Systems Commands. Systems Commands (e.g. NAVELEX, NAVSHIPS, NAVAIR, etc.) sponsor projects which are the primary source of funds for NELC operations. There are many formal and informal interfaces with the Systems Commands which are carried on in various ways. For example, the WWMCCS Project Office in the Command Control and Communications Programs Department was established when NAVELEX informed NELC of their requirement through a task statement. A rough estimate of the task cost and schedule was prepared by NELC. NAVELEX then directed NELC to prepare a task summary which included items such as a task description, a funding summary, subtask descriptions, Quality Assurance requirements, Integrated Logistic Support considerations, test and evaluation requirements, etc. NAVELEX and NELC then negotiated cost, schedule and performance requirements prior to NAVELEX acceptance of the NELC prepared task summary. Once the task summary was accepted, it was comparable to a contract between NAVELEX and NELC.

In the initial phases of project establishment just described, there are many NELC and sponsor personnel and disciplines involved in the planning interface between NELC and the sponsor. Once the project is established there is one individual as the primary point of contact in the Systems Command that interfaces with the NELC project manager, but the project manager frequently must deal with other sponsor personnel in areas such as funding, Integrated Logistic Support, etc.

Not all NELC projects are sponsored in the Naval Systems Commands (Figure 9). Approximately one quarter of NELC projects are sponsored by other sources such as the Director of Laboratory Programs, the Marine Corps, other Navy sources, other Department of Defense sources and other government sources (Figure 10 contains examples of non-Navy sponsored programs in fiscal 73). Each of these projects requires the same basic interfaces as Systems Command sponsored projects.

Another important external interface for NELC project managers is in the area of commercial contractor support. One of the primary sources of project support comes from external sources (e.g. the MEECN Project relied upon contractor support for approximately twenty-five percent of its tasks). If a project requires support in a particular area which is not available from a NELC functional department or can be obtained at a better cost and schedule from a contractor, the project manager may develop a



NELC FUNDING BY SPONSORS
60
40
20
0
$ MILLIONS
69
70
71
72
73
74
FISCAL YEAR
EST
OTHER SPONSORS
MARINE CORPS
DLP
AIR
ELEX
SHIPS
6/30/73

Figure 9.

NON-NAVY PROGRAMS (30 JUNE 73)

GOVERNMENT

SPONSOR	TITLE	PROBLEM NUMBER	FY 73 FUNDS ($K)	
Air Force	Solar Telescope Image	M206	50	
	Fiber Optics Radiation Effects	F218	50	
	Airborne VLF Propagation	M215	50	
	Advanced Anti-Radiation	H101	56	
	Short Pulse Backscatter	D211	50	
	Detector Evaluation	T301	50	
	Hydrus	B218	25	
	Emissivity Evaluation	T302	5	
				336
Army	Detector Evaluation	T301	200	
	PIDEP	F209	75	
	RF Signature Sensor	F108	62	
	Surveillance with UV	K285	10	
	Advanced Anti-Radiation Sensor	H101	2	
	ADP Services	K337	20	
				369
ARPA (OSD)	Develop and Improve Ribbon Wiring	R215	100	
	Fiber Optics Evaluation	T304	62	
	Detector Evaluation	T301	100	
	Transmittance Measurement	T302	50	
	Integrated Optics Circuits Technique	F215	370	
	Remote Sensor	D308	92	
	Blue-Green Dye Laser	B403	60	
				834
DCA	Scintillation Effects on SATCOM	M405	50	
	VLF/LF Propagation	M216	100	
	DCA Data Compressor	R304	120	
				270
DNA	Ionospheric VLF-ELF Propagation	M402	127	
	Atmospheric Dynamics in Ionosphere	M213	25	
	VLF-ELF Nuclear Weapon Effects	M208	175	
				327
FAA	FAA-VLF Handbook	A206*	15	
	Automatic Monitoring	R136*	250	
				265
NASA	Solar Contour Mapping	M214	25	
				25
U.S. Coast Guard	Antenna Improvement	B169	18	
	Omega	A107/110	262	
				280
U.S. Postal Service	Remote Video Encoding	N451*	100	
	Facts Visibility System	K347	60	
				160

*Technology Transfer

Figure 10.

SPONSOR	TITLE	PROBLEM NUMBER	FY 73 FUNDS ($K)		
APL-Johns Hopkins	HF Sounder	M212	30		
				30	
Bureau of Standards	Fabricate Field Sensor	K273*	6		
				6	
	Total Government				2,902.0
	NON-GOVERNMENT				
AETL	Shock Test	K288	3		
Cubic	Shock and Indication Test	K287	1		
Langley Corp	Vibration Test	K258	15.1		
Motorola	Drop Hammer Shock Test	K269	0.7		
RCA	Shock Test/RF Amp	K278	1.2		
Science Application Inc	Computer Rental	K330	0.5		
Sonetronics	Inspection/Testing	T271	0.4		
Dynal	Inspection/Testing	T271	1.0		
U.C. Scripps	Support	K408/523/ 909/218	47.0		
Chu Assoc	Testing	K216	18.3		
Univ of Wash	FORACS–SACS	R112	95.0		
	Total Non-Government				183.2
	Total Non-Navy Programs				3,085.2

Figure 10. Continued.

*Technology Transfer

relationship with a commercial contractor in order to obtain the necessary support for his project. In addition, the Administration and Technical Support Department, through the Supply and Contract Services Division, will interface with the Navy Regional Procurement Office, Long Beach in contracting for the required support.[36] This interface is further discussed in Chapter IV.

The "fleet" is another external interface with which NELC must maintain close contact. As the user of NELC developed equipment, the fleet necessarily provides inputs to project offices. These are sometimes direct inputs to the project office through a fleet liaison staff and are some times indirect inputs through the Systems Command sponsor. For example, the WWMCCS project organization contains a Fleet Liaison Staff which maintains direct contact with fleet units concerned with the project. Another example of a fleet interface is the test and evaluation of laboratory developed prototypes conducted in operational commands by laboratory personnel.

The Naval laboratory and the projects within it maintain many other external interfaces which have varying degrees of importance to the organization. A few examples include: professional meetings in technical areas, seminars

[36]NELC has purchase authority of $2,500 for routine requirements and $10,000 for emergencies. Any requirement which exceeds these thresholds must go through NRPO Long Beach.

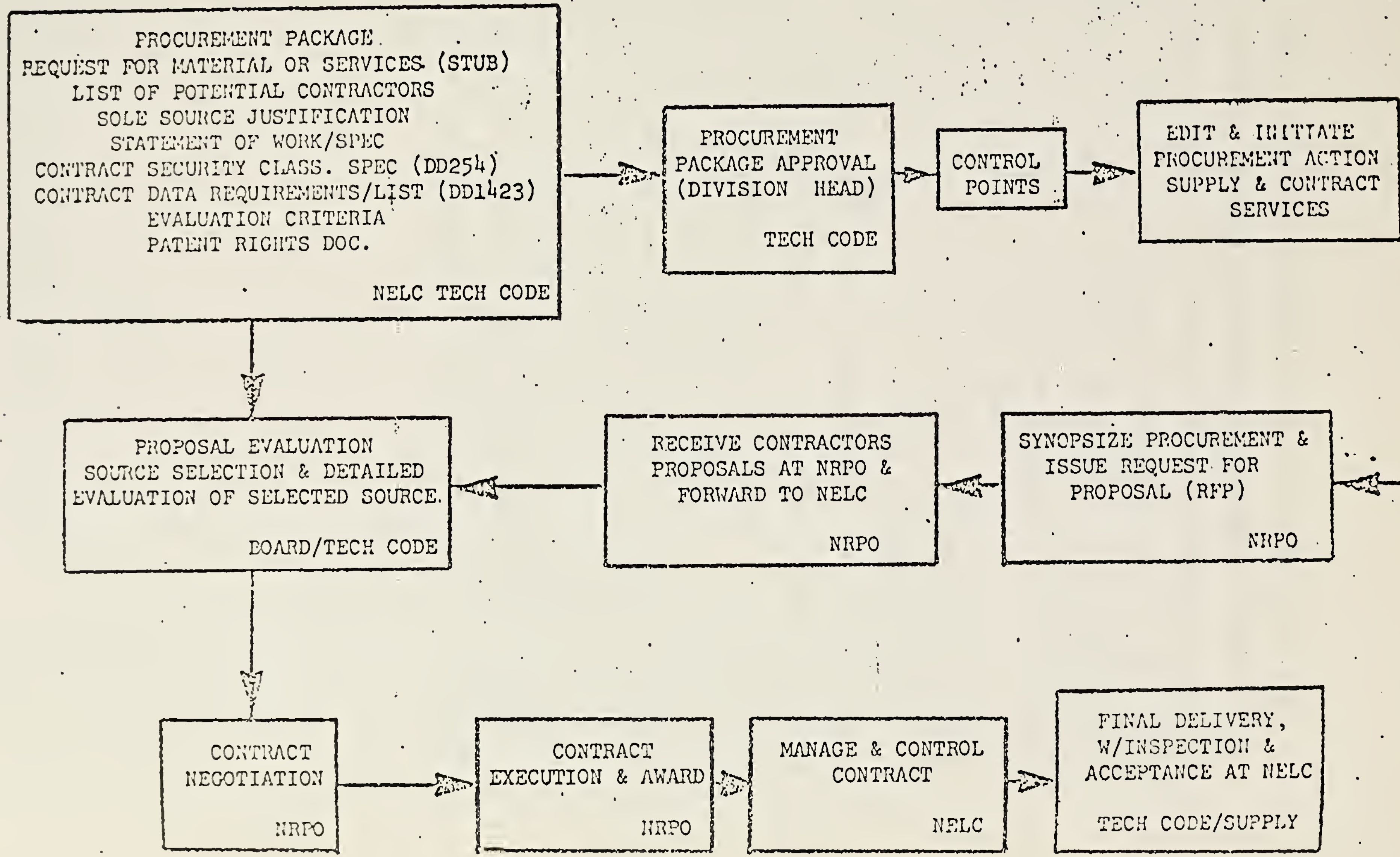
with industry, management consultant groups, educational institutions and other laboratories.

2. Internal Interfaces

The NELC matrix organization chart indicates that the project manager must maintain many internal interfaces throughout the system. His primary interface with the technical functional departments is with the task leader who is assigned in the functional department to work on a given task for his project. In the personnel area, the project manager has little direct influence as to the choice of individuals assigned to his project within a functional department (i.e. the functional division head knows his personnel, what type project each is best suited for, manages his resources to support many projects and is the line authority for functional task leaders). However, the project manager will sometimes "politic" to influence the assignment of a certain key individual when he has definite feelings that the individual and task are well matched.

The project manager must also work closely with Administrative and Technical Support Department personnel, particularly in the Supply and Contract Services Division. If his project requires support from commercial contractors, the project manager must maintain a close relationship with contract specialists in the Supply and Contract Services Division to ensure that the required items in the procurement package (Figure 11) are properly prepared and sufficient lead time is allowed to prevent project schedule slippages.

Figure 11. NELC PROCUREMENT CYCLE FLOW CHART



Many projects interface directly with the staffs which come under the Deputy Technical Director (Figure 8). These staffs include such areas as systems analysis, Quality Assurance, advanced technologies and planning; and are used to varying degrees by different projects. For example, the WWMCCS Project Office utilizes analysis personnel (Code 230) as integral parts of its organization.

Finally, an important internal interface which must be maintained in any organization is the line authority chain of command within each department. The project manager is working for two bosses, his project sponsor and his superior in the department chain of command. The interface with his chain of command superior concerns the areas of internal procedures, personnel assignments, reports and any dealings up or down the chain of command. However, the fact that the project manager often feels obligated to satisfy his project sponsor first and his department superior second, is a good example of the "golden rule"[37] in project management.

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[37] The man with the gold makes the rules.

IV. THE PROJECT MANAGER IN THE SYSTEM

A. INTRODUCTION

A project manager and a project sponsor were on a hunting trip. One morning the sponsor woke up early and went into the brush to get a lead on a bear which was reported to be in the area. The project manager was about to join him companion when he heard two shots and a blood chilling roar. His friend came running toward the tent yelling, "Open the flap! Open the flap!" Just as the project manager opened the flap, the sponsor ran into the tent chased by a huge bear not twenty yards behind him. As the sponsor ran through the tent and out the back he shouted, "You take care of this one while I bring in another one!"

This chapter is concerned primarily with the man in the tent, the project manager. The problems which confront the project manager in the Naval laboratory are many and varied. In the previous chapter some general problems and interfaces with which he must contend were discussed. In this chapter the history of project management, NELC project manager's profile, planning and control problems and use of the systems approach will be discussed. The problems and techniques presented are generally applicable to project managers in a matrix organization regardless of size or type of project. Many problems which are discussed were contributed by the project managers who were interviewed and some are inherent in a matrix organization. The project

managers and associated personnel interviewed are not quoted directly, but some of the thoughts and words used are paraphrases and composites of the remarks of several.

B. HISTORY OF PROJECT MANAGEMENT

The origin of project management can be traced to World War II and the Manhattan Project in 1942.[38] The concept of project management has evolved and changed over a number of years and may have been called by different titles in earlier usage. The technique of project management today is viewed in the Department of Defense as a means to deal with the problems experienced in the acquisition of weapon systems.

The prime mover in the evolution of project management was the technological revolution which made possible the complex systems of today. The technology which initiated the Manhattan Project was the nuclear physics of Albert Einstein. Although the Manhattan Project had an extremely high wartime priority, success may not have come so rapidly (project initiation to first bomb in three years) without the use of good project management techniques.

In addition to the Manhattan Project, defense requirements for large quantities of complex systems forced industry to look for new ways to manage development and production.

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[38]The Manhattan Project was the effort to develop the first atomic bomb.

Difficulties involved in obtaining new weapons in a reduced amount of time created difficult management-type problems. Industry looked to project management as one possible solution.

The military services have used some form of project management techniques since the mid-1950's. The Air Force created the Ballistic Missle Division with the responsibility of managing the Atlas, Thor and Titan programs; the Navy organized the Special Projects Office for management and development of the Polaris missle; and the Army established the Army Ballistic Missle Agency to develop the Jupiter missle. Each of these organizations had similarities that indicated a need for special management techniques. Each program was given high priority within the services and had first choice of personnel, authority over support organizations, exemption from normal procurement procedures, access to top officials and special funding. A project manager was selected and provided with special authority over personnel, materials, facilities and funds. These were important projects and contributed significantly to the evolution of project management in the military.

By 1961 the techniques of project management had been applied to many acquisitions other than missles within the services. However, there was a wide range of policies and procedures used from one service to the next and within each service. A task force was formed to study acquisition methods throughout the services with emphasis on project

management techniques. The result of the study was a set of recommendations which included: more extensive use of project management techniques as found in the Air Force and Navy, use of Program Evaluation and Review Technique (PERT) should be encouraged, more work should be done in the area of delegation of powers to project managers and all services should employ a common management technique for use in acquiring complex weapon systems.

Interest in project management continued to increase throughout the 1960's with conferences, studies and courses on project management techniques in the Department of Defense. In May, 1965, DoD Directive 5010.4, "System/Project Management" attempted to pull the services together in their efforts to manage projects. The Directive was intended for major designated projects and covered mandatory and nonmandatory application of project management techniques and procedures. Major system acquisition in the Department of Defense has continued to require the use of a chartered project manager and project management techniques.

In recent years, the project management concept has been applied to many other functions where there is a specific objective which, when achieved, means the end of the function. Project management today is widely used in industry where a specific product must be developed and many functional lines must be crossed in its development. Industrial project management developed along the same lines as the Department of Defense project management. Technological

advances with the accompaning need to concentrate responsibilities for development and production effort in one organization were the primary factors responsible for its adoption.

The application of project management techniques to the Naval laboratory is a direct result of the successes achieved on other government and industrial projects. The advantages of project management techniques for equipment development are obvious when applied to organizations where the emphasis is on projects with specific objectives and well-defined points of completion (as in the Naval laboratory development project). In recent years, the use of project managers and project management techniques has proven to be an effective management concept.

C. NELC PROJECT MANAGER PROFILE

The laboratory project manager is a key individual in a process which is meant to provide for more economical and effective acquisition of equipment having the required performance and operational availability which can be sustained in a designated military environment. As a key individual in the development project, his responsibilities cover many areas and he should have a versatile background in administrative areas associated with engineering as well as in engineering technology.

From the interviews and research conducted at NELC, a "typical" laboratory project manager profile can be developed. He is forty-five years of age, has been with the laboratory

for eight years, has a degree in electrical engineering and has had experience in his field prior to coming to the laboratory. This profile does not fit any particular individual, but is an aggregate of the backgrounds of a sample of twelve NELC project managers (Figure 12). This "typical" profile reflects the Naval Electronics Laboratory Center orientation with the project manager's educational background in electrical engineering, his main field of activity. In addition, from the twelve profiles available to the authors, it is clear that a basic premise of Chapter I is supported in that only two (E and K in Figure 12) appear to have any management training in their background. Also, two of the twelve project managers in the sample hold advanced technical degrees.

However, any specific project managers background will vary and his opinions as to what is most important in his background will vary greatly from project manager to project manager, depending on how he views his function. One project manager interviewed had obtained his undergraduate degree in electrical engineering/physics and his masters degree in management. He considered the management degree as the most important to the management function which he performed. In other words, he viewed his job as that of a manager and considered the management education, experience and techniques which he possessed as being the most useful in accomplishing his project objectives. On the other hand, another project manager with a degree in electrical engineering and a minor in business administration considered the

PROJECT MANAGER PROFILES

(Sample of 12 NELC P.M.'s)

PROJECT MANAGER	AGE	EDUCATION	WORK EXPERIENCE LAST TEN YEARS	YRS AS P.M.	YRS AT NELC
A	46	B. S. ElctEng	NOL Corona NELC	12.0	3.2
B	38	M. S. Computer	NASA & NELC	4.0	5.8
C	41	B. S. Physics	Ryan & NELC	4.0	9.7
D	49	B. S. ElctEng	London NELC	7.3	11,7
E	50	B. S. BusMgmt	Navy & NELC	7.4	7.4
F	35	B. S. ElctEng	Aeronutronic NELC	5.1	5.1
G	38	M. S. ElctEng	Andrews AFB NELC	3.4	3.4
H	35	B. S. Math	NELC	4.0	5.8
I	36	B. S. ElctEng	Assoc.Aero Sci. Labs & NELC	4.0	9.4
J.	31	B. S. ElctEng	NSRF, Guam NELC	5.0	13.0
K	44	B.E./B.B.A. ElctEng	NUWC, TAA NELC	5.9	5.9
L	50	M. S. ElctEng	NELC	12.0	22.8

Figure 12.

management portion of his education as unimportant. He viewed his job as that of a developmental engineer. He felt he hadn't used the management portion of his education in his past experience and most of the formal management procedures learned had been forgotten. He believed that management training would be of value in managing his project but that he was too busy dealing with pressing problems to take advantage of any formal management training which was available.

It was obvious to the authors that the manner in which the two project managers tracked their projects reflected their feelings on the importance of a management orientation. There seemed to be organized, orderly procedures for project control in the first, while the second was a "put out the fire" approach. However, both project managers were managing projects which appeared to be successful in that they were making progress toward the development of a desired system and kept their sponsor well enough satisfied to continue supplying funds. In addition, both had been laboratory project managers before assignment to their current projects. This tends to support a statement from an earlier interview that a NELC project manager remains in project mangement if he "gets the job done."

The ability to do whatever is necessary to "get the job done" is probably the single most important trait in a project managers makeup. He must be able to make decisions which are necessary to accomplish project objectives.

Formal mangement education can be an invaluable part of the project manager's background to aid him in making the right decisions, but is not essential. Experience gained on prior projects or assignments and individual judgement, common sense and an intuitive feel for making the right decision can enable the project manager to successfully control his project. The ability to plan, organize, control and communicate is essential to getting the job done in any project and every project manager accomplishes these functions one way or another, with or without formal procedures. He may not view himself as a manager but he is at the focal point of every major problem area of his project. His ability to handle these problems (which will be discussed in the next section) has a direct bearing on whether his project is successful, partially successful or cancelled. The problem areas referred to are management problems and are problems which tend to recur frequently. There is no intention here to imply that technical problems are less severe; they may in fact be the toughest ones to solve, but they are generally unique. The recurring problem areas are management problems and require a management ability (whether formal education or experience in the project manager's background) in order to arrive at workable solutions.

D. PLANNING, CONTROLLING AND THE SYSTEMS APPROACH

The problem area concerned with planning has a major effect on management problems within a project. Most problems

which develop in a project can be traced to poor planning in the earlier stages. All other project functions depend on planning, deciding what to do, when to do it and where to do it. The project manager must plan for scheduling, budgeting, contingencies, personnel, reports, etc. and use the systems concept of planning which requires looking at the organization as an integration of all of its parts. Many problems associated with project management can be reduced or eliminated with good planning early in the project's life.

The primary results of faulty, unrealistic or incomplete planning is loss of control over many aspects of the project which can eventually result in complete loss of the project. This should be incentive enough for any project manager to do his utmost to ensure that adequate planning for his project is accomplished. This planning should begin in the project proposal stage with the sponsor's task statement and continue throughout the life of the project. The early planning should include project organizational structure, schedules, manpower requirements, in-house and contractor efforts, funding requirements, etc. This initial planning effort is the key to a successful project with a minimum of problems. It is a guideline for normal project operations and is a baseline to fall back on in meeting unexpected changes and crises.

Planning techniques which may be used by a project manager vary in complexity and usefulness, depending on the

size and complexity of the project. A small single function project may require a relatively simple plan and planning technique while a large complex multifunction project may require many planning techniques and documents to provide adequate direction. However, all projects should have a <u>written</u> plan covering what is to be done, how, when, by whom, what it will cost, major foreseeable problems and possible solutions.

A detailed explanation of planning techniques which are useful to the project manager is beyond the scope of this paper. Some general techniques which project managers have found to be useful in project planning and which develop into project control tools as the project progresses include:

- a cumulative expenditure budget which plots time versus expenditures;
- a rate of expenditures budget which plots time versus expenditure rate;
- bar charts with project milestones;
- networks and the critical path;
- work breakdown structures which can set the stage for all subsequent planning;
- make or buy analysis; and
- PERT, which is an excellent planning device because it details the sequence of steps necessary to project completion based on their relation to each other.

Some illustrations and discussion of these techniques can be seen in Appendix A.

Planning is one of the initial problems the project manager must face and it is not an easy task. However, if

he realizes that thorough, complete, well thought out plans will help to avoid many of the problems which may develop in the future, planning should become easier. The project manager's attitude toward planning is reflected in his project organization and the control which he maintains over his project. In the examples of two project managers cited earlier, one viewed his job as that of a manager and his management orientation was reflected in thorough, detailed project planning, while the other viewed his job as that of a developmental engineer with little emphasis on management and his project did not appear to contain any plan to assure that the project progressed toward its end objectives. For example, the second project was in the advanced development stage and there was no plan for reliability requirements, Quality Assurance or Integrated Logistic Support nor were milestones which had been developed in planning closely monitored. In fact, the project manager stated that milestone reports (i.e. keeping track of milestones made and missed) were not used, were not helpful in project control and were only prepared because it was a requirement. Additionally, there appeared to be no real control system used to track project progress (i.e. PERT, Gantt charts, milestones, graphs, etc.). There seemed to be a general feeling that paperwork/reports might be of some value but there wasn't time enough to prepare and use them. Lack of administrative support was cited as one reason that the project appeared to be a generally "off the cuff" operation. It

appeared to the authors that with some additional planning and budget control the project might find funds available to hire enough administrative support to allow the proper use of project control techniques. For example, it appeared that the only fund controlling and monitoring technique used was a weekly computer printout which presented the amount each functional code had expended on the project the previous week.

In contrast, the first project contained detailed networks with milestones from project initiation to completion, all responsible personnel were identified, there was a comprehensive Integrated Logistic Support plan and Quality Assurance plan and complete budgeted expenditures were laid out. In short, where the project was ultimately headed, where it had been and where it would be at any point in the future was very clear. In the opinion of the authors, this type of detailed planning can make the project manager's job much easier, solve many problems as they arise and give the project a much greater chance for success.

Another problem area for the project manager is in controlling his project's day to day operations. The primary elements concerned with project control are budgets, costs, schedules and progress. If a project manager can maintain control of these four elements he can maintain control of his project. Costs and progress refer to actual costs and progress while budgets and schedules refer to planned costs and progress. The project manager must be able to track actual

versus planned in order to know when significant deviations occur and take action to correct the deficiency.

Various methods were used by laboratory project managers to maintain control of costs and progress. One of the better systems was based on the use of milestones and milestone reports. The milestone report was an important tool for the project manager in controlling his project and could be prepared in various ways. The project manager might receive an input from each responsible task leader, prepare the milestone report and distribute it. Using this method does not necessarily obtain the fullest cooperation from task leaders and functional managers because they might interpret the report as only reflecting the project manager's viewpoint and biases and feel that the milestone report did not reflect their problems or the real reason a milestone was missed.

The World Wide Military Command Control System Project Office appeared to the authors to have an excellent method of implementing their milestone and milestone report control system which encompassed the systems concept philosophy. The WWMCCS Project Manager felt that one of his prime functions was to obtain the cooperation, understanding and full support of functional personnel for his project. Therefore, he prepared a detailed milestone report on a weekly basis which was a function of a Monday milestone/project review meeting. This meeting was attended by project personnel and all functional task leaders assigned to accomplish

project tasks. If a milestone had been missed in the previous week or was expected to be missed in the near future, it was discussed with the responsible task leader, the report was prepared and was eventually reviewed at the department head level. Since one of the prime objectives of the project manager was to obtain and present a clear and total picture of his project's progress and schedule, the contents of every milestone report was prepared with the cooperation and agreement of the responsible task leader and his input was the most important part of the report.

In addition to milestones, the WWMCCS Project Office prepared a monthly management control document for use as a project control tool. Again, the most important input came from the functional departments and gave the project manager a more accurate overall view and better understanding of his project and the organization. This document contained networks with milestones for each task leader, cumulative milestones met and missed to date with an explanation of any missed and a plot of budgeted versus actual costs to date. The explanation of missed milestones included an estimate of its probable effect on the project as a whole and a new expected completion date for the milestone.

Another weekly meeting was used for the project configuration management program and included a review of detailed engineering change requests, engineering change orders and field engineering change reports. The day to day tools used by the project manager to control his project included

graphs, Gantt charts and networks. An example is the financial status chart which is strictly a project manager's tool and tracks budgeted versus actual expenditures (Appendix A contains examples of project control tools, some of which were used in the WWMCCS Project Office).

There was also frequent contact with task leaders, contractors and the sponsor through telephone calls and meetings. The project manager felt that the management tools which he used were essential if he was to maintain adequate control of his project and a clear understanding of the problems and relationships which affected it throughout the organization.

Whatever management control techniques the project manager uses, they must tell him what progress (in both schedule and performance) he is getting for the money he is expending, give him enough detail on trouble areas so that he can take the required action, and enable him to see upcoming problems. To know where, when, why and what kind of action to take, the project manager must be able to track his project cost, schedule and performance. He must simultaneously consider all these elements of his project and their effect on each other. How well he does this determines the effectiveness of his management — whether he will control the project or be controlled by the project.

A major problem area which created much concern within every project office and for each project manager interviewed was budget cuts. The project manager has little

control of budget cuts from his project sponsor and there seems to be no optimum way to plan for or predict cuts in total funds. Planning for contingencies can include a plan for certain cuts in particular areas to aid in the accompanying reduction of effort, and the project manager should have priorities set up from the most to least critical areas in his project. When a budget cut comes from the sponsor, there are basically three methods a project manager can use to reduce the funds to the functional departments. He can eliminate the lowest priority tasks if he has planned with priorities in mind and the nature of his project allows it. He can reduce the level of effort on each task by a set percentage and settle for reduced performance and a less desirable schedule. Finally, he can try to reduce the funds to the functional departments so as to have the least impact on his project while at the same time considering the current situation in each functional department (manpower utilization, current need for funds, etc.) and make cuts that have the least effect on the entire organization. Again, to do this he must have planned with priorities in mind so he knows where he can accept less performance.

As indicated in Chapter II, the authors consider the systems approach as primarily a management philosophy or way of thinking which a project manager can use as a framework to visualize the system in which he operates and how his project or area of responsibility is constrained and

influenced. The systems concept can make the job of managing a project easier by giving a better understanding of the system, but it can also make some decisions more difficult be requiring the consideration of more variables (e.g. the decision to use in-house effort rather than an outside contract for the development of a particular module might be easily made if the only variable considered is initial cost).

The systems approach can be applied when considering the method used by a project manager in distributing funds. If the project manager is always thinking of his project alone and always makes decisions in the light of their immediate effect on his project, he may attempt to use commercial contractors to a maximum extent in order to obligate as much of his budget as possible to guard against budget cuts (i.e. funds within the laboratory are easily recalled by a sponsor while funds obligated in a contract are not). This method of handling funds may reduce the difficulty of a future project decision when a budget cut comes, but it may also cause problems in the overall system. The functional departments are partially dependent on the Command Control and Communications Programs Department as a source of funds. If the functional departments are not utilized whenever possible by project managers, in the long-run the total system may suffer.

Most successful project managers employ the systems approach to project management whether they realize it or not.

In the example on budget cuts, one project manager interviewed used the systems approach in the decision-making process concerning redistribution of funds to the functional areas involved in his project. After receiving a budget cut from his sponsor, the project manager would first look at areas which were least critical to the project as primary candidates for the major portion of the fund reduction. At the same time however, he would look at the present and possible future situation in the particular functional departments concerned. Factors such as the workload in the department, its present need for funds and its ability to transfer personnel to other projects might be considered or might be factors which eventually tip the scales in favor of a greater fund reduction in one functional area versus another.

A project manager must know the organization in which he operates. He should know how each subsystem within the total system functions and their relationship to each other in order to understand the overall effects his decisions will have. An example of using the systems approach or considering other subsystems in the organization when making project decisions is in the area of contracting. The laboratory project manager must understand the procurement process and exactly what is involved in government contracting with commercial sources. The Supply and Contract Services Division within the Administrative and Technical Support Department performs a very important function for the project manager when he must utilize a commercial contractor

to perform a certain task or level of effort. The contract specialists are in the organization to facilitate the NELC procurement cycle (Figure 11) and act as an interface between the project manager and the Navy Regional Procurement Office (NRPO). A primary part of the procurement cycle and one which must be understood by the project manager is the procurement leadtime (Figure 13). If the project manager is aware of the procurement requirements and procedures which must be accomplished prior to contract award, makes an attempt to bring the contracting specialists into the preparation of the procurement package as early as possible and understands the constraints which face anyone involved in government procurement, he will not only be increasing the probability of having a successful project but will be helping the total system to meet its objectives.

A project manager cannot sit in his office, make his plans and control his project without understanding the requirements of other subsystems. For example, a project manager may have planned for many months to procure a particular piece of equipment which he needs on a certain date to meet his schedule. Without really understanding the leadtime involved in the procurement, he prepares the procurement package and it arrives on the contract specialist's desk with a notation to the effect that the item "must be in the project office within thirty days or the schedule is shot." If the procurement requires competition according to the Armed Services Procurement Regulations,

The following indicates average number of days elapsed between the time the purchasing office receives a complete procurement package to contract award.

		Calendar days
a.	Requirements to be negotiated with an estimated cost in excess of $2,000,000	210
b.	Requirements to be negotiated with an estimated cost between $300,000 and $2,000,000	160
c.	Requirements to be negotiated with an estimated cost between $100,000 and $300,000	143
d.	Requirements to be negotiated with an estimated cost between $10,000 and $100,000	91
e.	Requirements to be formally advertised in excess of $10,000	120
f.	All other requirements, exclusive of Installment Funding	60
g.	Amendments involving exclusively the addition of funds in accordance with an existing Installment Funding Clause	20

Figure 13. Procurement Leadtimes.

the leadtime required just to get the contract signed may be ninety days or more. If the need is urgent enough and another procurement method can be justified, the contracting division may be able, through extra effort and some kind of "firedrill," to reduce the leadtime and meet the project's schedule. If the project manager had understood the effort involved, he may have brought the contracting specialist in much earlier and been able to prevent many headaches for himself and others. Looking at his organization as a system made up of subsystems which affect each other, the project manager can reduce many of his problems and total system problems.

A final example of the systems approach in laboratory project management is in the area of personnel. A project manager normally has little real influence on the selection of which individuals will be assigned to his project from the functional departments, but can sometimes "politic" to influence the assignment of a certain key individual when he has strong feelings that the individual and task are well matched. This procedure can be beneficial to both the project and the organization as a whole if not carried to an extreme. If a particular project manager, because of his project's priority or his persuasive ability, is able to obtain the best qualified people from each functional department with which he deals, his project will be well staffed with the best talent but other projects and overall organizational effectiveness will suffer. To use the systems

approach, the project manager must view manpower management as a subsystem interacting with other subsystems in the organization. He should develop a personnel program that is adaptable to his project and can be directed toward establishing and maintaining an adequate and satisfactory project team. He must strive to staff his project with personnel who are compatible with the objectives of his project, not necessarily the individuals who appear best qualified in every technical area.

To use the systems approach is not difficult but it requires the ability to see beyond the immediate effects and advantages of a given decision. It requires the ability to see the "big picture" or what is best for the total system in the longrun. It may even require a project manager to say "this project is not going anywhere, it's a waste of money and should be discontinued" with the full knowledge that if it is dropped, he must find a new project and source of funds.

V. CONCLUSIONS

The systems approach to management is a way for the manager to view his environment which allows him to make more viable decisions. If the laboratory project and project manager functioned in a vacuum; if every decision affected only the project; then the systems approach would not apply to NELC. However, from the very nature of the laboratory organizational structure and from the manner in which it operates (as described in Chapters III and IV), it is apparent to the authors that the systems approach is the most applicable management concept for NELC.

The systems approach has been applied by some project managers (although they may not have called it the systems approach) with success. Other management approaches may be more successful in some situations over the short-term, but the systems approach should provide the most rewarding long-term benefits for the laboratory project manager.

The NELC project manager is normally an engineer or an individual with a technical background. This technical training is of prime importance to the project manager and helps him to deal with the difficult, complicated and sometimes unsolvable technical problems which are encountered in a development project. However, when a developmental engineer moves from the laboratory bench to the project manager's desk, the recurring problems which he must face are management problems. Budgeting, re-budgeting and

tracking expenditures for example, are day to day problems which are encountered. Failure to effectively plan for and control these types of problems can lead to the failure of a project just as surely as the inability to solve a major technical problem can be a project's downfall.

Therefore, the laboratory project manager must realize that he is more than an engineer. He is also a manager and he must develop a management philosophy which will enable him to cope with the management problems he faces. The management tasks should not be underestimated. Careful attention should be paid to the planning process, including the identification and analysis of alternatives and a clear cut understanding of the actions and responsibilities of supporting personnel both within and outside the Naval laboratory. In addition, the project manager must have an effective control system that provides timely feedback on potential problems and allows him to take corrective action. He must have a management orientation or philosophy which allows him to see the entire project and all of its interfaces.

In interviews conducted over the six month period, there appeared to the authors to be no universal understanding or use of the systems approach. However, it was obvious that some project managers operated under the systems philosophy and thought positively in a managerial sense and that to some extent the systems approach was used by everyone interviewed. In other words, for a project manager to successfully

function in an environment such as NELC where frequent contact is required with subsystems other than his own, he must be able to understand and obtain the cooperation of these subsystems. Otherwise he will not be likely to remain a project manager. Nevertheless, in the opinion of the authors he can be a more effective project manager if he is aware of the systems concept and attempts to make every decision in the light of its affect on other subsystems and the total system.

The NELC project manager appeared to operate under some constraints which may not be common to project managers in general. Within his organization he operated as an individual in a chain of command with a supervisor directly above who placed demands upon him. He also had to satisfy his project sponsor who was external to the organization. The fact that he was trying to satisfy two bosses whose objectives might not coincide is in conflict with basic principles of any management approach. An example was the individual who let internal requirements slide so he would have time available to satisfy sponsor requirements. In his mind, and maybe rightly so, he could not justify the time required to deal with all internal demands. This type of situation will make it more difficult for the individual manager to practice the systems approach (i.e. when the demands of one interface are seen as all important, the relationship with others is degraded).

Another constraint with which the NELC project manager must deal is in the area of commercial contracts. The project manager in industry normally has complete control of his project and can subcontract tasks when necessary. The laboratory project manager on the other hand, has no contracting authority. In fact, to contract with a commercial vendor he must go through two more systems or organizations. First, he deals directly with contracting specialists in the Supply and Contract Services Division to prepare his procurement package. Then the Supply and Contract Services Division must interface with the Navy Regional Procurement Office which lets the contract. From the viewpoint of the project manager this is not an ideal contracting procedure, but it illustrates the necessity for the project manager to understand systems other than his own, know their constraints and procedures and made decisions which affect his project with the knowledge of their affect on those systems.

In preparation of the procurement package and specification writing, there appears to be a need for more cooperation and understanding between laboratory project managers and contracting personnel. At NELC, various methods could be used to promote a more effective interface between the contracting specialist and the project office. One method would be to divide the projects among the contracting specialists so that the individual specialist could more closely relate to specific projects, maintain close contact with his specific project managers and be better able to see progress and anticipate project needs.

At the same time, every project manager should take advantage of opportunities to increase his knowledge of procurement procedures and internal/external requirements placed on the Supply and Contract Services Division. For example, in December 1973 a short three day research and development procurement course was offered at NELC which presented an ideal opportunity for project management types to increase their understanding of the procurement process. Only two of the eighteen NELC personnel who attended the course were directly related to project management. The majority of the class consisted of contracting/supply personnel and the subject covered was basically a review for them. This type of course could be most beneficial to the typical project manager in furthering his knowledge of procurement procedures and improving his interface with contracting specialists.

Project management personnel should also take advantage of management training opportunities whenever possible and higher level management should see that these opportunities are made available. Any training course which is offered should be well advertised throughout the organization and its intended purpose should be specified (i.e. procurement orientation for project management personnel, specific management training, etc.). The opinion was expressed that some type of management training would be nice but, as a project manager, there was not time to attend courses, etc. Be that as it may, the authors feel that if a project manager

would take the time to acquire a few good management tools through training, the "fires" which require immediate and constant attention would be much less common and time consuming.

A prime consideration in enabling laboratory project managers to understand and use the systems approach is in the attitude of higher level management. If senior managers realize that the transition from developmental engineer to project manager is not always an easy one and that some individuals should have a mangement orientation or training to more successfully meet organizational and project objectives, then management training will be made available and project managers and prospective project managers will be strongly encouraged to take advantage of it.

Finally, in the opinion of the authors, the matrix organization as utilized at NELC is an effective and flexible structure, well suited to meet both project and functional goals. With its many interfaces and subsystems it is the ideal structure in which a project manager can practice the systems approach to management. The project manager may "get by" with no management philosophy or the philosophy that what's good for his project is good for the total system. However, the authors believe that if a project manager will consciously practice the systems approach to management his job will be easier, his project will have a better chance for success, other subsystems' goals will be more easily met and the total system will benefit.

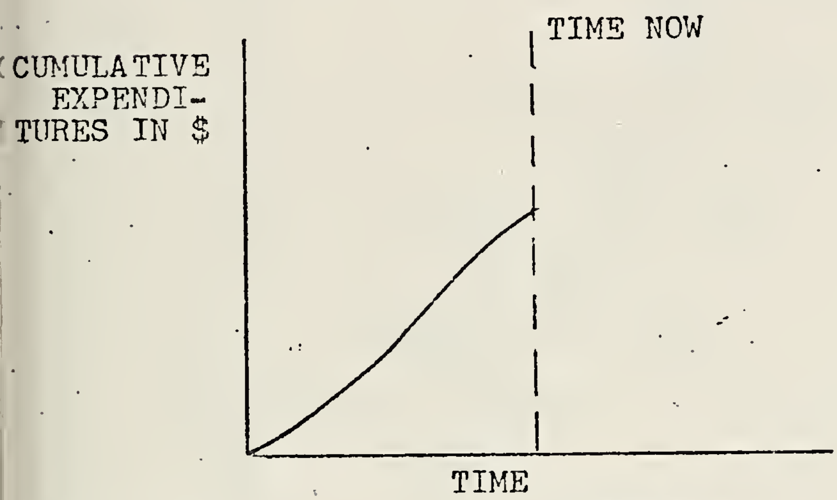
APPENDIX A: SOME ILLUSTRATIONS AND DISCUSSION OF PLANNING AND CONTROL TOOLS

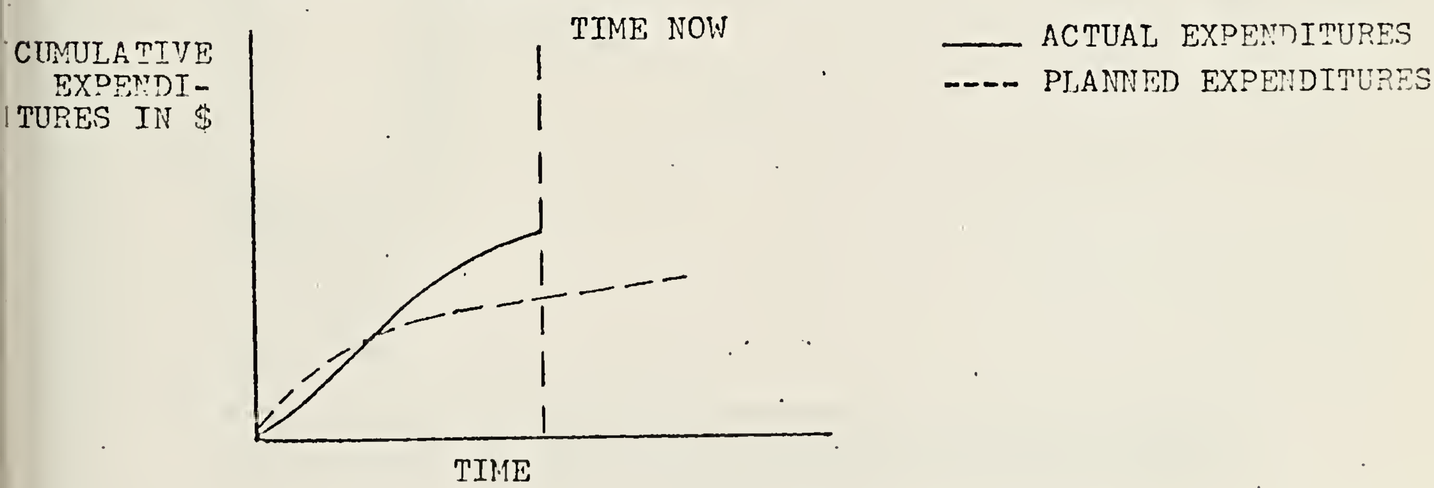
The following pages contain some general examples of planning and control tools and techniques which can be useful in managing a project, along with some specific examples of tools used by a laboratory project manager to plan for and control his project. Some examples are very simple and their purpose is one of illustration. However, some project managers could probably increase the value of their planning and control by thinking about how they might apply something as simple as a plot of planned versus actual expenditures to their project.

At the end of this appendix there is a brief discussion of PERT which is intended as a familiarization. An illustration of PERT is beyond the scope of this paper but a detailed explanation can be obtained from many sources, one of which is MIL-P-23189A (Navy) dated 25 October 1962, a milspec on PERT/Time and PERT/Cost Management.

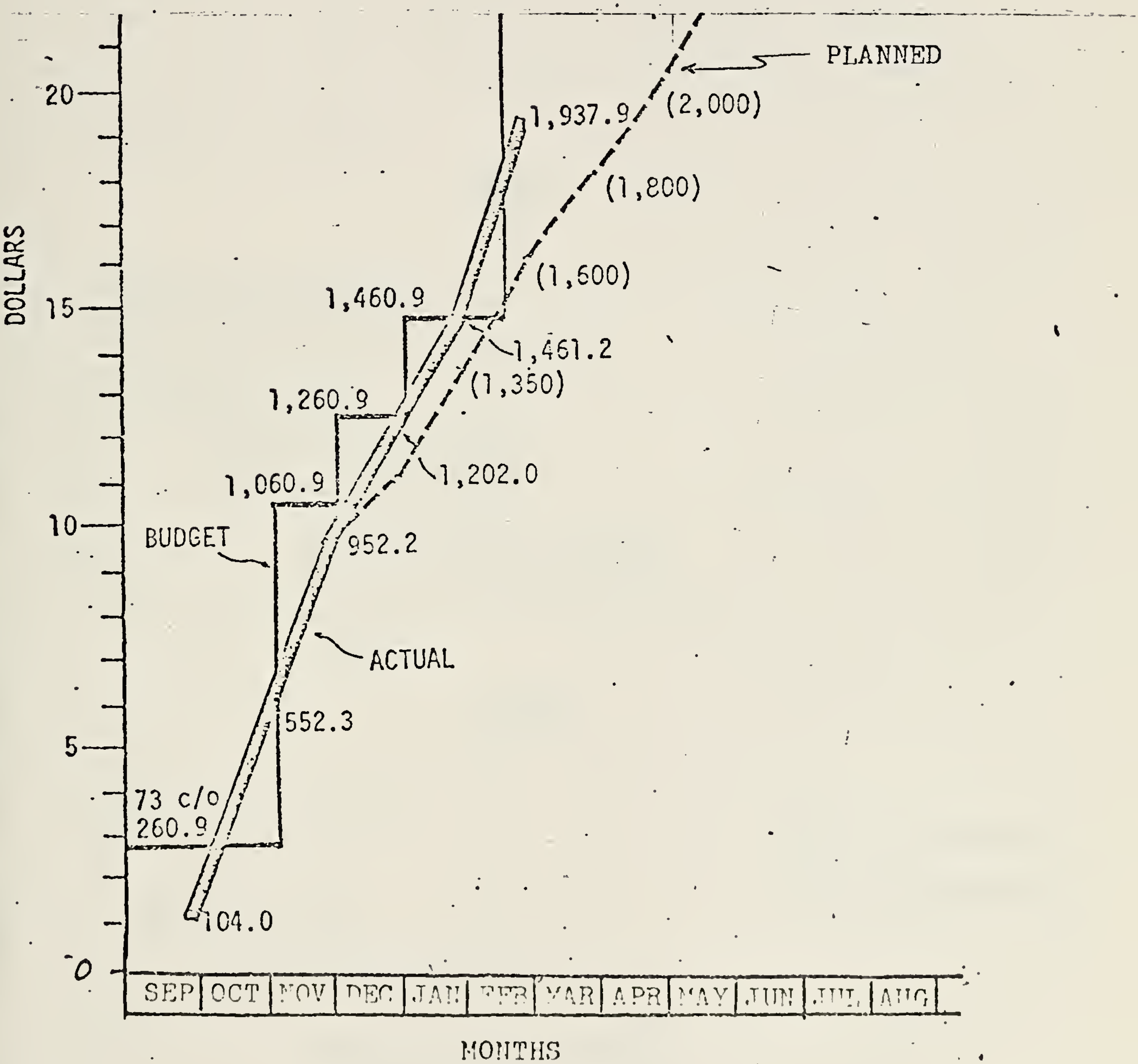
TRACKING EXPENDITURES VERSUS BUDGET

It is not controlling to track cumulative expenditures as in the upper chart. Expenditures must be compared with planned expenditures (budget) as in the lower chart in order that deviations may be detected and corrective action taken. The upper chart gives a manager very little useful information. The lower chart, however, clearly points out that more money than planned is being spent and that something had better be done soon to correct the trend.



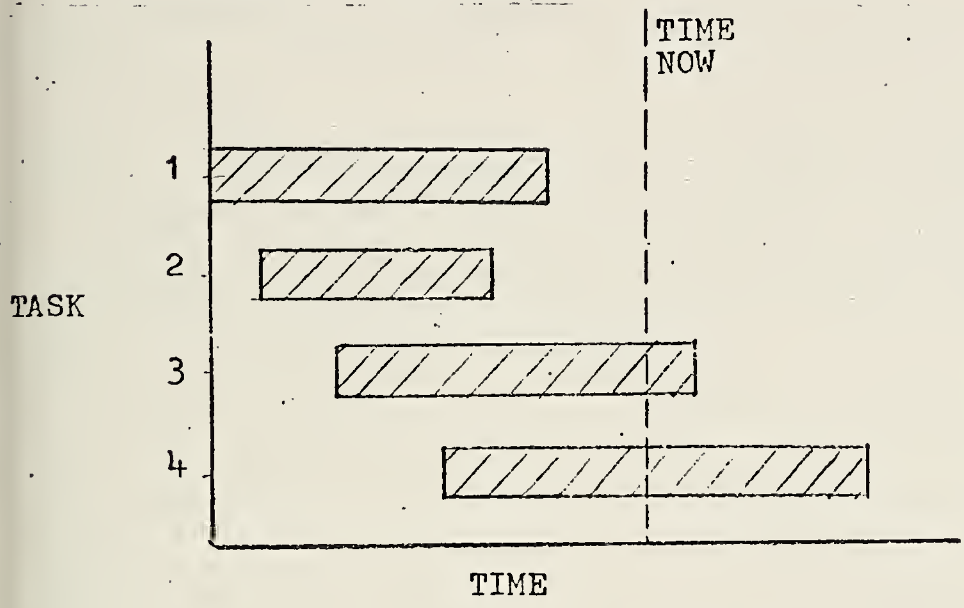


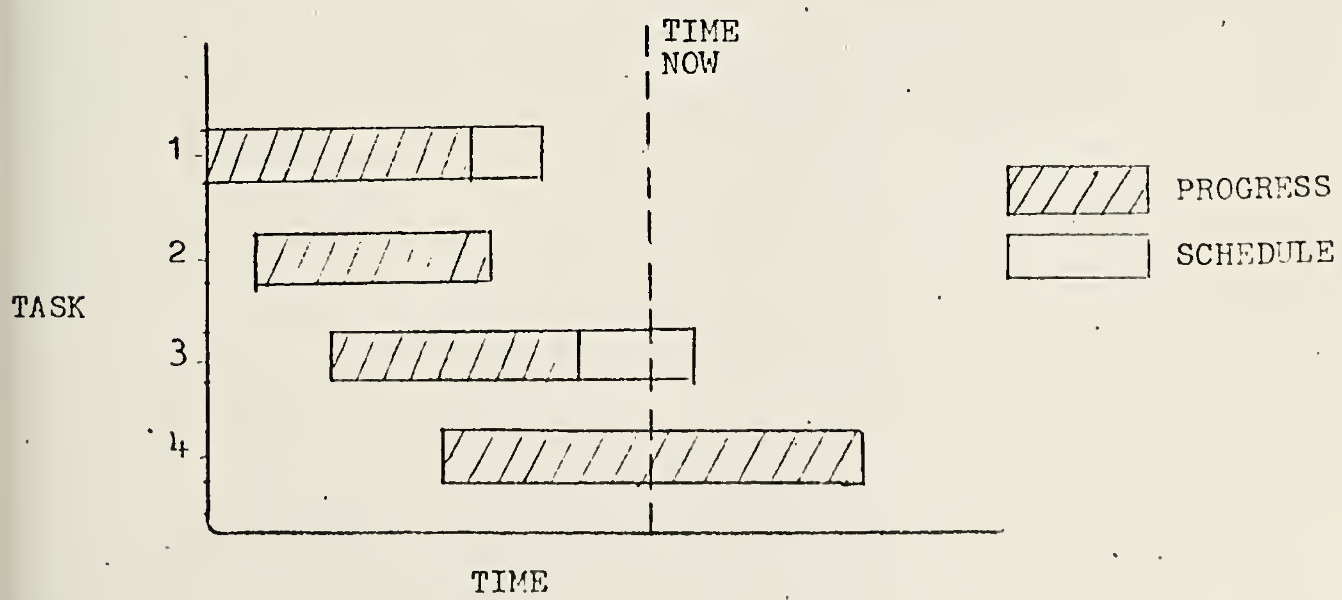
The chart depicted below is an illustration of a chart used to track expenditures with funds budgeted (in this case budgeted means funds set aside for the project's use), funds actually expended and planned expenditures all shown.



BAR CHARTS

Bar charts are another tool which can be used to track progress and may be as simple or as detailed as desired. However, as can be seen from the two charts below, an indication of tasks completed (upper chart) is almost meaningless compared to progress versus schedule (lower chart). The lower chart clearly points out that tasks 1 and 3 are behind schedule while 2 is complete and 4 has been completed well ahead of schedule.





NETWORK AND MILESTONE CHARTS

The following four pages are examples of typical milestone charts used by the WWMCCS Project Office primarily for planning purposes. The milestone charts are made up by the task leaders and submitted to the project manager for approval. Milestone charts are excellent tools to aid in the planning process but are also used to track the project.

It is not intended that the reader interpret the figures, symbols, etc. on the charts, they are simply examples of control tools in use by a particular project.

IWA N424-3A	COMMUNICATION SUBSYSTEM DESIGN		REV	PROJ. MGR. Initial	PROJ. MGR. Date	TASK LDR. Initial	TASK LDR. Date
	Task Leader: H. HOLMERUD	Code 1130	A		8/24/73		8/24/73
APPROVED:	(Project Manager)	8/15/73 (Date)	B		9/14/73		9/14/73
	(Task Leader)	8/24/73 (Date)	C		[illegible]		[illegible]
			D		[illegible]		[illegible]

FY-74 SEP	OCT	NOV	DEC	JAN	FEB	MAR

COMMUNICATION SUBSYSTEM DESIGN

Page 2
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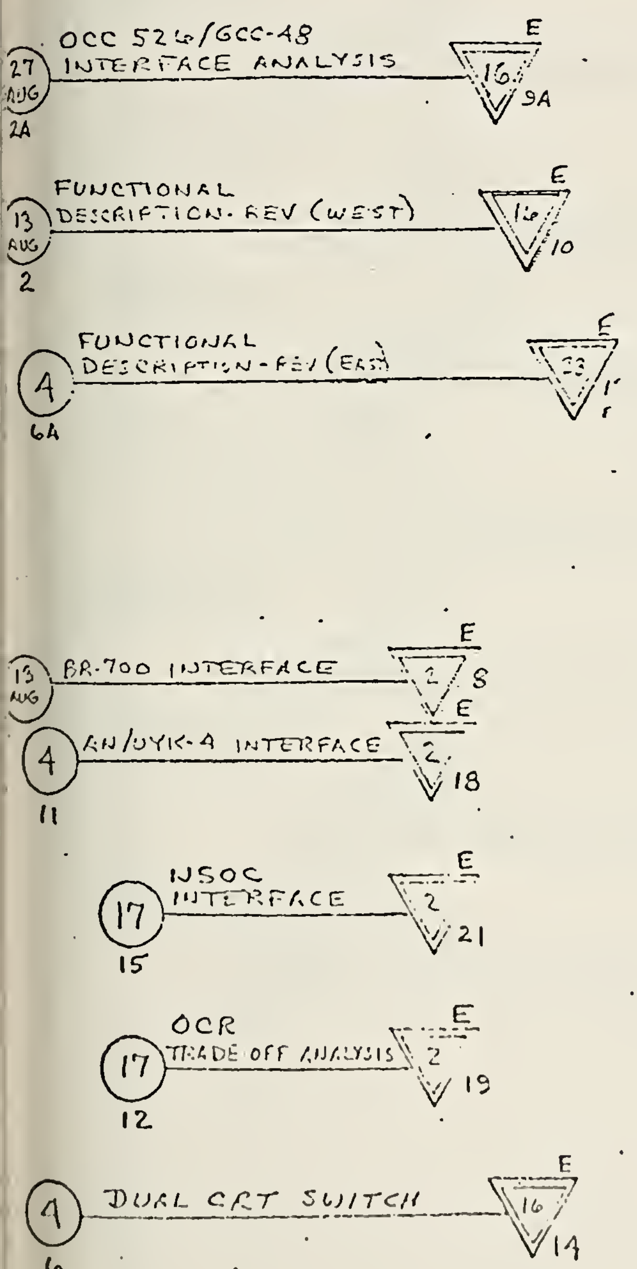


IWA N424-3C

COMMUNICATION SOFTWARE DEVELOPMENT

Task Leader M. OPSTAD

Code 5330

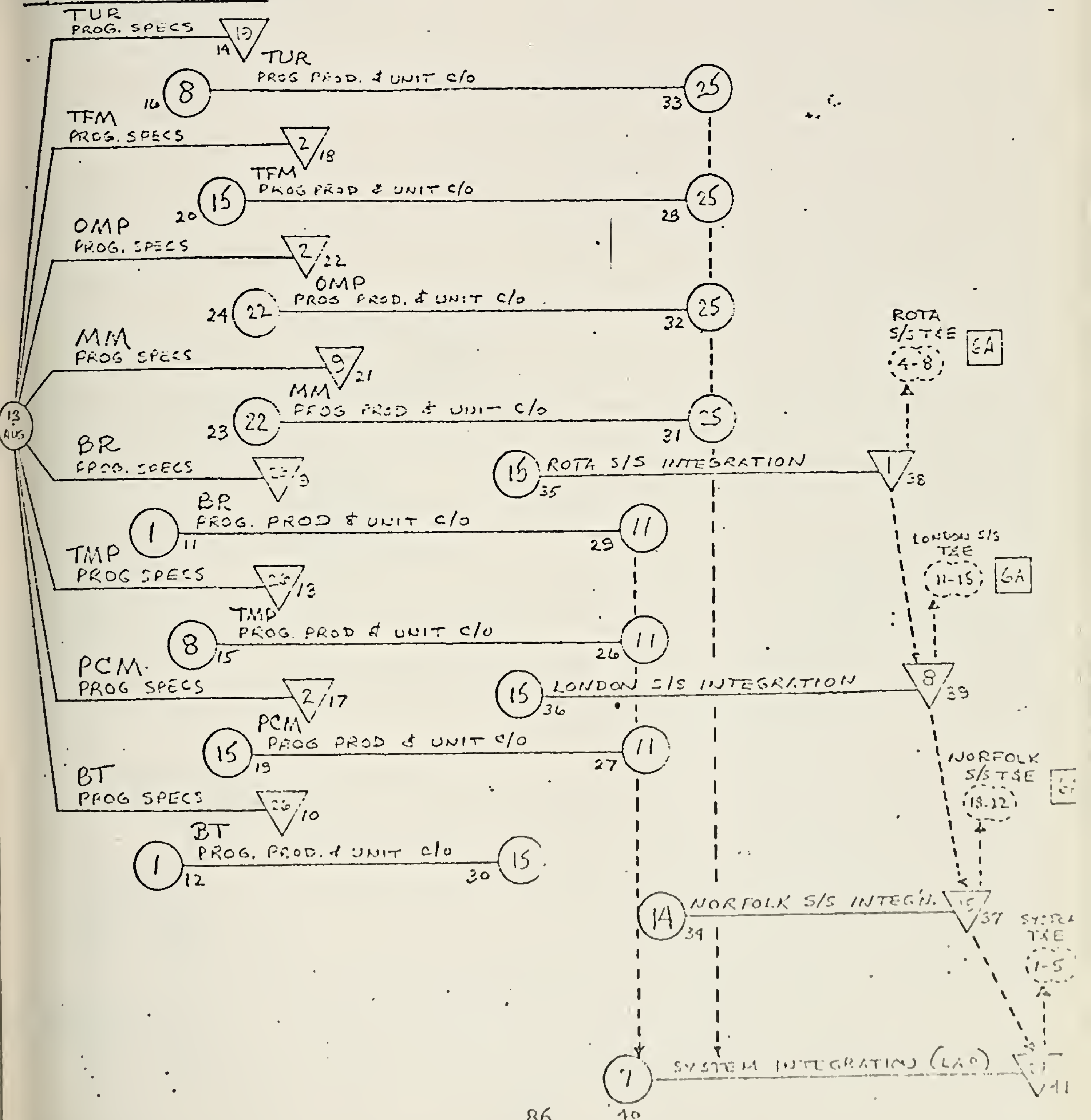
APPROVED: (Project Manager) 8/15/73 (Date)

(Task Leader) 8/27/73 (Date)

REV	PROJ. MGR. Initial	PROJ. MGR. Date	TASK LDR. Initial	TASK LDR. Date
A		9/17/73		9/17/73
B		11/6/73		11/6/73
C				
D				

FY-74 SEP	OCT	NOV	DEC	JAN	FEB	MAR

APPLICATION SOFTWARE

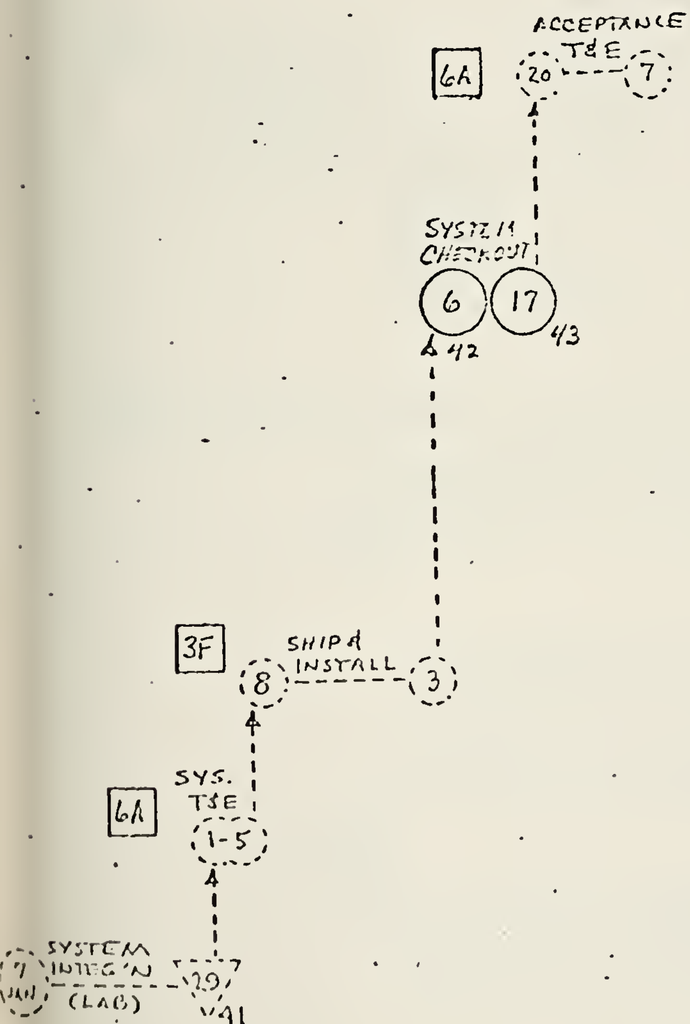


IWA N424-3C	COMMUNICATION SOFTWARE DEVELOPMENT		REV	PROJ. MGR. Initial	PROJ. MGR. Date	TASK LDR. Initial	TASK LDR. Date
	Task Leader M. OPSTAD	Code 5330	A	[illegible]	9/17/73	[illegible]	9/17/73
APPROVED:	(Project Manager)	8/15/73 (Date)	B	[illegible]	11/6/73	[illegible]	11/6/73
	(Task Leader)	8/27/73 (Date)	C				
			D				

FY-74 MAR	APR	MAY	JUN	FY-75 JUL	AUG	SEP

Page 1 (Cont'd)

APPLICATION SOFTWARE (Cont'd)



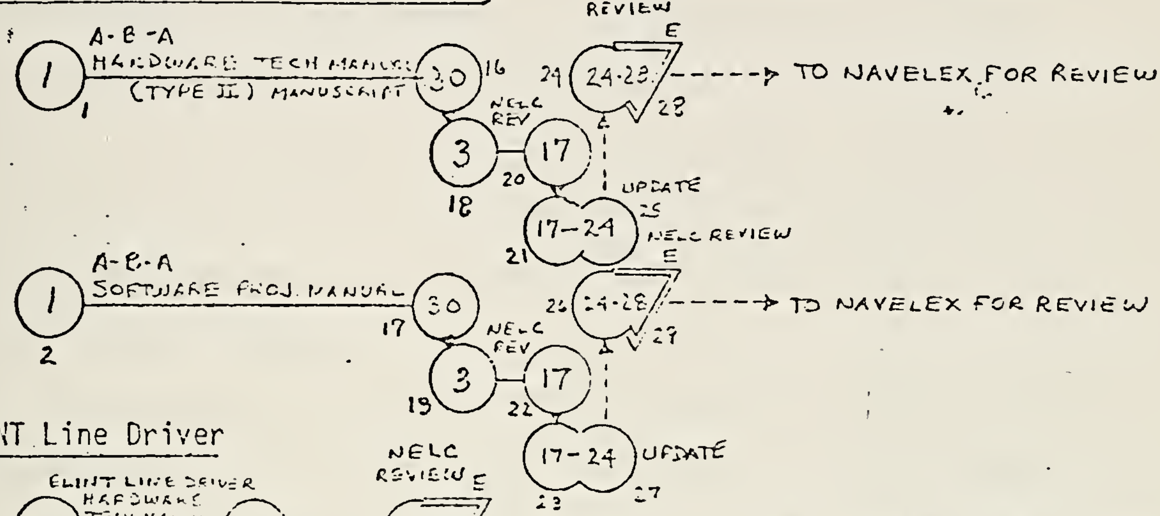
IWA N424-3H	NEDN/NIDN & DFC DOCUMENTATION		REV	PROJ. MGR. Initial	PROJ. MGR. Date	TASK LDR. Initial	TASK LDR. Date
	Task Leader M. STONE	Code 6430	A		11/5/73		11/5/73
APPROVED:	(Project Manager)	9/14/73 (Date)	B				
	(Task Leader)	9/20/73 (Date)	C				
			D				

FY-74 SEP	OCT	NOV	DEC	JAN	FEB	MAR

DOCUMENTATION

Page 1

ASCII-Baudot-ASCII Converter Unit



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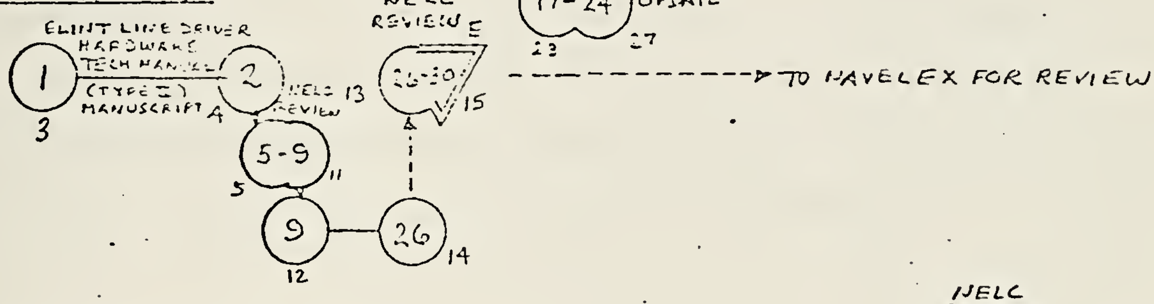
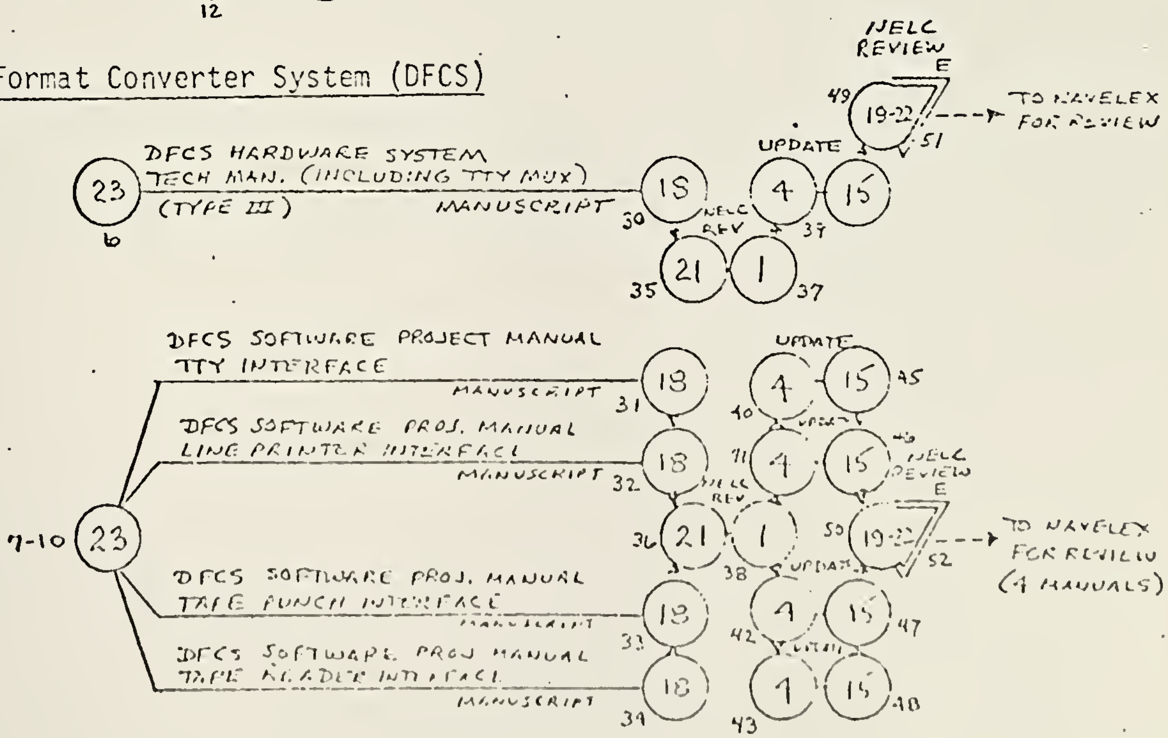


Digital Format Converter System (DFCS)



MILESTONE REPORTS

An example of a typical milestone report is contained in the following seventeen pages. This particular milestone report was prepared by the WWMCCS Project Office to cover the week ending 7 December 1973. The milestone report is an excellent control tool in that it gives an overview of the entire project (excluding funds) and allows the manager to see progress made and expected to be made in the future.

It should be noted that milestones are explained and discussed in the report along with their probable impact on the project. The fact that a milestone was missed may or may not be significant, depending upon its relationship to other milestones and the project as a whole.

ONE REPORT - DETAIL

PROBLEM MANAGER, CODE 1130
PROGRAM MANAGER, CODE 1100

PROBLEM/PROJECT: N424/OSIS

WEEK ENDING: 7 December 1973

MILESTONE No.	MILESTONE IDENTIFICATION		RESPONSIBLE CODE	MILESTONE DATE SCHEDULED	MILESTONE DATE REVISED	MILESTONE DATE ACTUAL	CHECK ONE: MADE	MISSED: Resp Code	MISSED: Other	CURRENT WEEK MISSED
05	Trade-Off Anal-Est Posit Methods	D	230	E 11/16		11/20	X	X		
08	OSIS/ISS Funct Descrip (Final)	D		E 12/15						
	Previous FY-74 Milestones completed						3	0	2	
						TOTALS	1	1	0	
						FY-74 TOTALS	4	1	2	

D: S = Start F = Finish P = Preliminary D = Deliverable E = External Deliverable * = Completed early

MILESTONES MISSED (INCLUDE REASONS, EFFECT ON PROBLEM/PROJECT, REMEDIAL ACTION TAKEN, AND WHEN)

Chart REV A

SIGNATURE

DATE 10 December 1973

TONE REPORT - DETAIL

PROBLEM/PROJECT N424/OSIS

WEEK ENDING 7 December 1973

PROBLEM MANAGER, CODE 1130

PROGRAM MANAGER, CODE 1100

MILESTONE No.	MILESTONE IDENTIFICATION		RESPONSIBLE CODE	MILESTONE DATE SCHEDULED	REVISED	ACTUAL	CHECK ONE: MADE	MISSED: Resp Code	MISSED: Other	CURRENT WEEK MISSED
201	LFC Prog Spec Mods	S	5320	10/29		10/29	X			
202	COQ Prog Spec Errata	S		11/12		11/12	X			
203	IOP Prog Spec Errata	S		11/12		11/12	X			
204	CDP Prog Spec Errata	S		11/19		11/19	X			
205	LFC Unit Checkout	S		11/19		11/19	X			
206	LFC Prog Spec Mods	D		11/30		*11/28	X			
207	CDP Prog Spec Errata	D		12/7		11/30	X			
208	DAP Prog Spec Errata	S		12/10						
209	COQ Prog Spec Errata	D		12/14						
210	IOP Prog Spec Errata	D		12/14						
211	Command Manual Errata	S		12/17						
212	DAP Prog Spec Errata	D		1/4						
213	Command Manual Errata	D		1/11						
214	LFC Integration	S		1/14						
215	LFC Prog Maintenance Manuals	S		1/14						
216	LFC Unit Checkout	F		1/18						
217	LFC Integration	D		2/8						
218	LFC Prog Maintenance Manuals	D		2/15						
						TOTALS	7	0	0	0

ND: S = Start, F = Finish, P = Preliminary, D = Deliverable, E = External Deliverable, * = Completed early

S MILESTONES MISSED (INCLUDE REASONS, EFFECT ON PROBLEM/PROJECT, REMEDIAL ACTION TAKEN, AND WHEN)

NATURE [signature]

DATE 10 December 1973

ONE REPORT • DETAIL

PROBLEM/PROJECT N424/OSIS

WEEK ENDING 7 December 1973

PROBLEM MANAGER, CODE 1130

PROGRAM MANAGER, CODE 1100

MILESTONE No.	MILESTONE IDENTIFICATION		RESPONSIBLE CODE	SCHEDULED	REVISED	ACTUAL	MADE	MISSED Resp Code	MISSED Other	CURRENT WEEK MISSED
701	Command Manual (2.0)	S	5320	7/2		7/2	X			
702	Program Maintenance Manual (1.7)	D		7/13		*7/12	X			
703	Program Maintenance Manual (2.0)	S		7/16		7/16	X			
704	Command Manual (2.0)	D		E 11/16		11/19	X	X		
705	Program Maintenance Manual (2.0)	D		E 12/14						
	Previous FY-74 Milestones completed						84	3	2	
						TOTALS	4	1	0	0
						FY-74 TOTALS	95	4	2	

D: S = Start; F = Finish; P = Preliminary; D = Deliverable; E = External Deliverable; * = Completed early

MILESTONES MISSED (INCLUDE REASONS, EFFECT ON PROBLEM/PROJECT, REMEDIAL ACTION TAKEN, AND WHEN)

Chart REV C

SIGNATURE Ronald A. Tull[illegible]

DATE 10 December 1973

ONE REPORT · DETAIL

PROBLEM/PROJECT N424/OSIS

WEEK ENDING 7 December 1973

PROBLEM MANAGER, CODE 1130
PROGRAM MANAGER, CODE 1100

MILESTONE No.	MILESTONE IDENTIFICATION		RESPONSIBLE CODE	MILESTONE DATE SCHEDULED	MILESTONE DATE REVISED	MILESTONE DATE ACTUAL	CHECK ONE MADE	MISSED Resp Code	MISSED Other	CURRENT WEEK MISSED
101	Phase 2.0 Training Plan	S	5320	7/4		7/4	X			
102	Phase 2.0 Lesson Plans/Trng Aids	S		9/4		9/4	X			
103	Phase 2.0 Training Plan	D		E 9/14	9/28	9/28	X	X		
104	Phase 2.0 Lesson Plans/Trng Aids	D		E 11/16	12/7	12/7	X	X		
	Previous FY-74 Milestones completed						15	1	1	
						TOTALS	4	2	0	0
						FY-74 TOTALS	19	3	1	

D:
S = Start F = Finish P = Preliminary D = Deliverable E = External Deliverable * = Completed early

MILESTONES MISSED (INCLUDE REASONS, EFFECT ON PROBLEM/PROJECT, REMEDIAL ACTION TAKEN, AND WHEN)

l milestones on this page have been completed.

ATURE

DATE 10 December 1973

ONE REPORT - DETAIL

PROBLEM/PROJECT N424/OSIS

WEEK ENDING 7 December 1973

PROBLEM MANAGER, CODE 1130

PROGRAM MANAGER, CODE 1100

MILESTONE No.	MILESTONE IDENTIFICATION		RESPONSIBLE CODE	MILESTONE DATE SCHEDULED	MILESTONE DATE REVISED	MILESTONE DATE ACTUAL	CHECK ONE: MADE	CHECK ONE: MISSED Resp Code	CHECK ONE: MISSED Other	CURRENT WEEK MISSED
201	ELINT Funct Descrip (Prelim)	S	5320	8/6		8/6	X			
208	Conversion Status Report	S		9/10		9/10	X			
209	EGC-10 Coding	S		9/10		9/10	X			
212	Conversion Status Report	F		10/19		*10/16	X			
213	EGC-10 Coding	F		10/19		*10/16	X			
214	Geo-Correlation Unit Checkout	S		10/22		10/22	X			
204	ELINT Funct Descrip (Prelim)	D		11/2		10/29	X	X	X	
205	Design Review (ELINT)	S		11/7		11/7	X			
210	Design Review (ELINT)	F		11/8		11/8	X			
211	ELINT Funct Descrip (Final)	S		11/12		11/12	X			
215	ELINT Funct Descrip (Final)	D		11/23	12/7	12/6	X		X	
216	Geo-Correlation Unit Checkout	F		11/30	12/7			X		X
217B	ELINT SSD (Sects 1-3)	S		12/3		12/3	X			
218B	ELINT Data Requirements	S		12/3				X		X
219B	ELINT SSD (Sects 1-3)	F		1/11						
220B	ELINT SSD (Prelim)	S		1/14						
221B	ELINT SSD (Prelim)	P		2/15						
222B	ELINT Data Requirements	P		2/15						
223B	ELINT Design Review	S		2/19						
224B	ELINT Design Review	F		3/1						
225B	ELINT SSD (Final)	S		3/4						
226B	ELINT SSD (Final)	D		E 3/15						
227B	ELINT Data Requirements (Final)	D		E 3/15						
	Previous FY-74 Milestones completed									
						TOTALS	12	3	2	2
						FY-74 TOTALS	12	3	2	

S = Start F = Finish P = Preliminary D = Deliverable E = External Deliverable * = Completed early

MILESTONES MISSED (INCLUDE REASONS, EFFECT ON PROBLEM/PROJECT, REMEDIAL ACTION TAKEN, AND WHEN)

No. 216 - This milestone was missed due to delay in receipt of mail. Estimated completion date is 14 December 1973. No impact on the program is anticipated. Responsible code is Code 1130.

No. 218B - This milestone was missed due to key person being on leave. Estimated start date is 10 December 1973. No impact on the program is anticipated. Responsible code is Code 5320.

Chart REV B

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DATE 10 December 1973

NE REPORT - DETAIL

PROBLEM/PROJECT N424/OSIS

WEEK ENDING 7 December 1973

ROBLEM MANAGER, CODE 1130

ROGRAM MANAGER, CODE 1100

No.	Milestone Identification		Responsible Code	Milestone Date: Scheduled	Revised	Actual	Made	Missed: Resp Code	Missed: Other	Current Week Missed
1	AN/UYK-4 Interface	S	1130	9/4		9/4	X			
6	Dual CRT Switch	S		9/4		9/4	X			
5	NSOC Interface	S		9/17		*9/4	X			
2	OCR Trade-Off Analysis	S		9/17		*9/4	X			
8	BR-700 Interface	D		11/2	11/30	11/30	X	X		
8	AN/UYK-4 Interface	D		11/2		11/6	X		X	
1	NSOC Interface	D		11/2		11/6	X		X	
9	OCR Trade-Off Analysis	D		11/2	11/16	11/15	X		X	
0	Functional Descrip Rev (West)	D		11/16	12/7			X		X
4	Dual CRT Switch	D		11/16	12/7			X		X
6A	Functional Descrip Rev (East)	S		9/4		9/4	X			
9A	OCC 526/GCC-48 Interf Analysis	D		11/16	12/7			X		X
2A	Functional Descrip Rev (East)	D		11/23	12/14			X		
	Previous FY-74 Milestones Completed						29	7	2	
	TOTALS						9	5	3	3
	FY-74 TOTALS						38	12	5	

: S = Start F = Finish P = Preliminary D = Deliverable E = External Deliverable * = Completed early

MILESTONES MISSED (INCLUDE REASONS, EFFECT ON PROBLEM/PROJECT, REMEDIAL ACTION TAKEN, AND WHEN)

o. 210 - This milestone was missed due to delay in typing. Estimated completion date is 14 December 1973. Minor impact on the program is anticipated. Responsible code is Code 1130.

o. 209A - This document was rejected by project QA on 6 December. Estimated completion date is 14 December 1973. Minor impact on the program is anticipated. Responsible code is Code 1130.

o. 214 - This milestone was missed due to underestimation of the complexity and time required for completion. Estimated completion date is 14 December 1973. Minor impact on the program is anticipated. Responsible code is Code 1130.

Chart REV D

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DATE 10 December 1973

ONE REPORT - DETAIL

PROBLEM/PROJECT: N424/OSIS

WEEK ENDING: 7 December 1973

PROBLEM MANAGER, CODE 1130

PROGRAM MANAGER, CODE 1100

MILESTONE No.	MILESTONE IDENTIFICATION		RESPONSIBLE CODE	MILESTONE DATE SCHEDULED	MILESTONE DATE REVISED	MILESTONE DATE ACTUAL	CHECK ONE: MADE	MISSED: Resp Code	MISSED: Other	CURRENT WEEK MISSED
111	BR Prog Prod & Unit C/O	S	5330	10/1		10/1	X			
112	BT Prog Prod & Unit C/O	S		10/1		10/1	X			
115	TMP Prog Prod & Unit C/O	S		10/8		10/8	X			
116	TUR Prog Prod & Unit C/O	S		10/8		10/8	X			
119	PCM Prog Prod & Unit C/O	S		10/15		10/15	X			
120	TFM Prog Prod & Unit C/O	S		10/15		10/15	X			
114	TUR Program Specs	D		10/19		10/19	X			
124	OMP Prog Prod & Unit C/O	S		10/22		10/22	X			
123	MM Prog Prod & Unit C/O	S		10/22		10/22	X			
113	TMP Program Specs	D		10/26		*10/26	X			
109	BR Program Specs	D		10/26		10/26	X			
110	BT Program Specs	D		10/26		*10/19	X			
117	PCM Program Specs	D		11/2		11/2	X			
118	TFM Program Specs	D		11/2		11/7	X	X		
122	OMP Program Specs	D		11/2		*11/1	X			
121	MM Program Specs	D		11/9	11/16	11/13	X	X		
135	ROTA S/S Integration	S		12/15						
136	LONDON S/S Integration	S		12/15						
130	BT Program Prod & Unit C/O	F		12/15						
140	System Integration	S		1/7						
126	TMP Prog Prod & Unit C/O	F		1/11						
129	BR Prog Prod & Unit C/O	F		1/11						
127	PCM Prog Prod & Unit C/O	F		1/11						
134	NORFOLK S/S Integration	S		1/14						
133	TUR Prog Prod & Unit C/O	F		1/25						
128	TFM Prog Prod & Unit C/O	F		1/25						
132	OMP Prog Prod & Unit C/O	F		1/25						
131	MM Prog Prod & Unit C/O	F		1/25						
	Previous FY-74 Milestones completed						10	0	0	
						TOTALS	16	2	0	0
						FY-74 TOTALS	26	2	0	

D: S = Start, F = Finish, P = Preliminary, D = Deliverable, E = External Deliverable, * = Completed early

MILESTONES MISSED (INCLUDE REASONS, EFFECT ON PROBLEM/PROJECT, REMEDIAL ACTION TAKEN, AND WHEN)

Chart REV B

SIGNATURE

DATE 10 December 1973

ONE REPORT • DETAIL

PROBLEM/PROJECT: N424/OSIS

WEEK ENDING: 7 December 1973

PROBLEM MANAGER, CODE 1130

PROGRAM MANAGER, CODE 1100

MILESTONE No.	MILESTONE IDENTIFICATION		RESPONSIBLE CODE	MILESTONE DATE SCHEDULED	MILESTONE DATE REVISED	MILESTONE DATE ACTUAL	CHECK ONE: MADE	MISSED: Resp Code	MISSED: Other	CURRENT WEEK MISSED
01	Install DFC-B/A Conv-MUX	S	4300	7/2		7/2	X			
02	DFC-B/A Conv-MUX Reprogramming	F		7/20		7/27	X	X		
03	Install DFC-B/A Conv-MUX	F		7/20		7/27	X	X		
04	Ship DFC-B/A Conv-MUX	F		7/20		7/20	X			
05	Checkout DFC-B/A Conv-MUX	S		7/23	7/30	7/30	X			
06	Checkout DFC-B/A Conv-MUX	F		8/21		8/21	X			
07A	DFCU Delivery	S		9/4		9/4	X	X		
08A	Data to Code 6430 (DFCU)	S		9/4		9/4	X			
09A	PM-16 Revision (DFCU)	S		9/4		9/4	X			
10A	DACOM Bypass Fab'n & Test	S		9/4		9/4	X			
11A	Data to Code 6430 (DACOM)	S		9/4		9/4	X			
12A	DFCU Delivery	F		10/1	11/2	11/2	X	X		
13A	Data to Code 6430 (DFCU)	F		10/5	11/9	11/9	X	X		
14A	PM-16 Revision (DFCU)	D		10/5		10/5	X			
15A	DACOM Bypass Fab'n & Test	F		11/2		11/2	X			
16A	Data to Code 6430 (DACOM)	F		11/2		11/2	X			
17A	NEDN/NIDN Installation	S		11/12		11/12	X			
18A	NEDN/NIDN Installation	F		12/14						
						TOTALS	17	5	0	0
						FY-74 TOTALS	17	5	0	

CODE: S = Start, F = Finish, P = Preliminary, D = Deliverable, E = External Deliverable, * = Completed early

MILESTONES MISSED (INCLUDE REASONS, EFFECT ON PROBLEM/PROJECT, REMEDIAL ACTION TAKEN, AND WHEN)

: Milestone No. 105 date revised on 7/20/73.

Chart REV A

SIGNATURE: [signature]

DATE: 10 December 1973

TO: RESPONSIBLE CODE(S) AND THEIR RESPECTIVE DEPT HEAD(S)

NE REPORT - DETAIL

PROBLEM/PROJECT N424/OSIS

WEEK ENDING 7 December 1973

PROBLEM MANAGER, CODE 1130
PROGRAM MANAGER, CODE 1100

MILESTONE NO.	MILESTONE IDENTIFICATION		RESPONSIBLE CODE	MILESTONE DATE SCHEDULED	REVISED	ACTUAL	CHECK ONE: MADE	MISSED: Resp Code	MISSED: Other	CURRENT WEEK MISSED
			2480							
B	Install Development Facility	S		8/13		8/13	X			
5B	Autodin Plan	S		9/4		9/4	X			
7B	Install Rota (Lab)	S		9/17		9/17	X			
3B	Install London (Lab)	S		9/24		9/24	X			
5B	Install Development Facility	F		9/28		9/28	X			
9B	Install Norfolk (Lab)	S		10/1	10/15	10/15	X		X	
0B	Autodin Plan	D		11/2		*11/1	X			
2B	Install Rota (Lab)	F		11/30	2/1				X	
3B	Install London (Lab)	F		12/7	TBD				X	X
5B	Install Norfolk (Lab)	F		12/14						
7B	Interconnect System	S		12/17						
3B	Interconnect System	F		1/4						
1B	Prepare for Shipment	S		2/25						
3B	Prepare for Shipment	F		4/5						
	Previous FY-74 Milestones completed						1	0	0	
	S = Start F = Finish P = Preliminary D = Deliverable E = External Deliverable * = Completed early					TOTALS	7	0	3	1
						FY-74 TOTALS	8	0	3	

MILESTONES MISSED (INCLUDE REASONS, EFFECT ON PROBLEM/PROJECT, REMEDIAL ACTION TAKEN, AND WHEN)

No. 113B - This milestone was missed due to late supply of PDP11 equipment from NAVELEX. Estimated completion date is to be determined and will be reported when known. Minor impact on the program is anticipated. Responsible code is Code 1000.

Chart REV C

SIGNATURE

DATE 10 December 1973

TO: RESPONSIBLE CODE(S) AND THEIR RESPECTIVE DEPT HEAD(S)

NELC-1-3000/1 (REV. 6-73)

ONE REPORT - DETAIL

PROBLEM/PROJECT N424/OSIS

WEEK ENDING 7 December 1973

PROBLEM MANAGER, CODE 1130

PROGRAM MANAGER, CODE 1100

MILESTONE No.	MILESTONE IDENTIFICATION		RESPONSIBLE CODE	MILESTONE DATE SCHEDULED	REVISED	ACTUAL	CHECK ONE MADE	MISSED [illegible] Code	MISSED Other	[illegible] WEEK MISSED
01	A-B-A Hdwre Tech Man (Type II)	S	6430	10/1		10/1	X			
02	A-B-A Software Proj Manual	S		10/1		10/1	X			
03	Elint L. D. Hdware Tech Man	S		10/1		10/1	X			
06	DFCS Hdware System Tech Manual	S		10/23		10/23	X			
07	DFCS Software Proj Man (TTY Int)	S		10/23		10/23	X			
08	DFCS Software Project Man (LPInt)	S		10/23		10/23	X			
09	DFCS Software Project Man (TPInt)	S		10/23		10/23	X			
10	DFCS Software Project Man (TRInt)	S		10/23		10/23	X			
04	Elint L. D. Hdware Tech Man	D		11/2		11/2	X			
05	NELC Review (No. 104)	S		11/5		11/5	X			
11	NELC Review (No. 104)	F		11/9		11/9	X			
12	Elint L.D. Hdwre Tech Man (Update)	S		11/9		11/9	X			
14	Elint L.D. Hdwre Tech Man(Update)	F		11/26		11/26	X			
13	NELC Review (No. 114)	S		11/26		11/26	X			
15	NELC Review (No. 114)	F		11/30		11/30	X			
16	A-B-A Hdwre Tech Man (Type II)	F		11/30	12/7	12/4	X	X		
17	A-B-A Software Proj Manual	F		11/30	12/14			X		
18	NELC Review (No. 116)	S		12/3		12/4	X			
19	NELC Review (No. 117)	S		12/10						
20	NELC Review (No. 116)	F		12/17		*12/7	X			
21	A-B-A Hdwre Tech Manual (Update)	S		12/17						
22	NELC Review (No. 117)	F		12/17						
23	A-B-A Softwre Proj Man (Update)	S		12/17						
25	A-B-A Hdwre Tech Manual (Update)	F		12/24						
24	NELC Review (No. 125)	S		12/24						
27	A-B-A Softwre Proj Man (Update)	F		12/24						
26	NELC Review (No. 127)	S		12/24						
28.	NELC Review (No. 125)	D		12/28						
29	NELC Review (No. 127)	D		12/28						
						TOTALS	18	2	0	0

D: S = Start P = Preliminary E = External Deliverable
F = Finish D = Deliverable * = Completed early

MILESTONES MISSED (INCLUDE REASONS, EFFECT ON PROBLEM/PROJECT, REMEDIAL ACTION TAKEN, AND WHEN)

Chart REV A

SIGNATURE Raymond C. [illegible]

DATE 10 December 1973

ONE REPORT - DETAIL

PROBLEM/PROJECT N424/OSIS

WEEK ENDING 7 December 1973

PROBLEM MANAGER, CODE 1130

PROGRAM MANAGER, CODE 1100

MILESTONE No.	MILESTONE IDENTIFICATION		RESPON-SIBLE CODE	MILESTONE DATE SCHEDULED	REVISED	ACTUAL	CHECK ONE: MADE	MISSED: Resp Code	MISSED: Other	CURRENT WEEK
201	NEDN/NIDN Hdwre Tech Manual	S	6430	10/15		10/15	X			
202	NEDN/NIDN Sftwre Proj Manual	S		10/15		10/15	X			
203	NEDN/NIDN Hdwre Tech Manual	F		12/14						
204	NEDN/NIDN Sftwre Proj Manual	F		12/14						
205	NELC Review (No. 203)	S		12/17						
206	NELC Review (No. 204)	S		12/17						
207	NELC Review (No. 203)	F		1/11						
208	NELC Review (No. 204)	F		1/11						
						TOTALS	2	0	0	0
						FY-74 TOTALS	20	2	0	

D: S = Start, F = Finish; P = Preliminary, D = Deliverable; E = External Deliverable, * = Completed early

MILESTONES MISSED (INCLUDE REASONS, EFFECT ON PROBLEM/PROJECT, REMEDIAL ACTION TAKEN, AND WHEN)

ATURE

DATE 10 December 1973

TO: RESPONSIBLE CODE(S) AND THEIR RESPECTIVE DEPT HEAD(S)

NND-NELC-1-3000/10 (REV. 1-7)

ONE REPORT - DETAIL

PROBLEM/PROJECT N424/OSIS

WEEK ENDING 7 December 1973

PROBLEM MANAGER, CODE 1130

PROGRAM MANAGER, CODE 1100

MILESTONE No.	MILESTONE IDENTIFICATION		RESPONSIBLE CODE	MILESTONE DATE SCHEDULED	MILESTONE DATE REVISED	MILESTONE DATE ACTUAL	CHECK ONE: MADE	MISSED: Resp Code	MISSED: Other	CURRENT WEEK MISSED
101	Comm Phase 1 SSD (Sect 1-2)	S	5330	11/5		11/5	X			
102	Comm Phase 1 SSD (Sect 1-2)	F		12/7		12/7	X			
103	Comm Phase 1 SSD (Sect 1-3)	S		12/10						
104	Comm Phase 1 SSD (Sect 1-3)	F		12/14						
105	Comm Phase 1 SSD (Preliminary)	S		12/17						
106	Comm Phase 1 SSD (Preliminary)	P		1/18						
107	Prep for Final Design Review	S		1/21						
108	Prep for Final Design Review	F		2/1						
109	Final Design Review	S		2/4						
110	Final Design Review	F		2/8						
111	Comm Phase 1 SSD (Final)	S		2/11						
112	Comm Phase 1 SSD (Final)	D		E 3/1						
						TOTALS	2	0	0	0
						FY-74 TOTALS	2	0	0	

D: S = Start F = Finish P = Preliminary D = Deliverable E = External Deliverable * = Completed early

S MILESTONES MISSED (INCLUDE REASONS, EFFECT ON PROBLEM/PROJECT, REMEDIAL ACTION TAKEN, AND WHEN)

ATURE: Ronald [signature]

DATE 10 December 1973

ONE REPORT • DETAIL

PROBLEM/PROJECT: N424/OSIS

WEEK ENDING: 7 December 1973

PROBLEM MANAGER, CODE 1130

PROGRAM MANAGER, CODE 1100

MILESTONE No.	MILESTONE IDENTIFICATION		RESPONSIBLE CODE	MILESTONE DATE SCHEDULED	REVISED	ACTUAL	CHECK ONE: MADE	MISSED: Resp Code	MISSED: Other	CURRENT WEEK MISSED
01	IDS Interface Design	S	5200	7/2		7/2	X			
02	Central Table Design	S		7/2		7/2	X			
03	Command Manual	S		7/2		7/2	X			
04	Central Table Design	F		7/27		7/27	X			
05	System Segmentation Design	S		7/30		7/30	X			
06	System Segmentation Design	F		8/31		8/31	X			
07	Subsystem Specs	S		9/4		9/4	X			
08	IDS Interface Design	D		E 9/28	10/5	10/5	X	X		
09	Subsystem Specs	D		E 9/28	10/5	10/5	X	X		
10	Command Manual	D		E 9/28	10/19	10/19	X	X		
11	Module (Program) Specs	S		10/1		10/1	X			
12	Test Data Base Development	S		10/1		10/1	X			
13	Module (Program) Specs	D		E 11/16		*11/13	X			
14	Program Prod & Unit C/O	S		11/19		11/19	X			
15	Test Data Base Development	F		11/30		*11/20	X			
16	Test Plan Development	S		12/3		12/3	X			
17	ISDS Prog Prod & Unit C/O	F		2/15						
18	Test Plan Development	F		2/15						
19	Subsystem Integration	S		2/18						
20	Module (Prog) Maint Manual	S		2/18						
21	Subsystem Integration	D		3/29						
22	Module (Prog) Maint Manual	D		4/26						
01B	Bulk Update Program Specs	S		11/26		11/26	X			
02B	ELINT Data Base Specs	S		1/14						
03B	Bulk Update Program Specs	D		1/18						
04B	Bulk Update Prog Prod & Unit C/O	S		1/21						
05B	Bulk Update Prog Prod & Unit C/O	F		2/18						
06B	Revise Comd Manual & SSD	S		2/21						
07B	ELINT Data Base Specs	D		3/15						
08B	Revise Comd Manual & SSD	D		E 3/29						
						TOTALS	17	3	0	0

D: S = Start; F = Finish; P = Preliminary; D = Deliverable; E = External Deliverable; * = Completed early

MILESTONES MISSED (INCLUDE REASONS, EFFECT ON PROBLEM/PROJECT, REMEDIAL ACTION TAKEN, AND WHEN)

Chart REV B

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DATE 10 December 1973

ONE REPORT - DETAIL

PROBLEM/PROJECT N424/OSIS

WEEK ENDING 7 December 1973

PROBLEM MANAGER, CODE 1130

PROGRAM MANAGER, CODE 1100

MILESTONE No.	MILESTONE IDENTIFICATION		RESPONSIBLE CODE	MILESTONE DATE SCHEDULED	REVISED	ACTUAL	CHECK ONE: MADE	MISSED: Resp Code	MISSED: Other	CURRENT
01	VIP Program Specs	S	5200	8/13		8/13	X			
02	ONH Program Specs	S		8/13		8/13	X			
03	OTCH Program Specs	S		8/13		8/13	X			
04	TCH Program Specs	S		8/13		8/13	X			
05	BTCH Program Specs	S		8/13		8/13	X			
06	RTCH Program Specs	S		8/13		8/13	X			
16	OTCH Program Specs	D		10/26	11/2	11/2	X	X		
17	OTCH Prog Prod & Unit C/O	S		10/29		10/29	X			
09	VIP Program Specs	D		11/2		*11/1	X			
13	TCH Program Specs	D		11/2		*11/2	X			
18	BTCH Program Specs	D		11/2		11/6	X	X		
19	RTCH Program Specs	D		11/2		11/5	X	X		
07	Data Base Specs	S		11/5		11/5	X			
11	VIP Prog Prod & Unit C/O	S		11/5		11/5	X			
15	TCH Prog Prod & Unit C/O	S		11/5		11/5	X			
21	BTCH Prog Prod & Unit C/O	S		11/5		11/5	X			
22	RTCH Prog Prod & Unit C/O	S		11/5		11/5	X			
10	ONH Program Specs	D		11/9		11/12	X	X		
12	ONH Prog Prod & Unit C/O	S		11/12		11/12	X			
14	Data Base Specs	D		12/21						
23	VIP Prog Prod & Unit C/O	F		12/21						
26	TCH Prog Prod & Unit C/O	F		12/21						
29	VIP Integration	S		12/26						
30	TCH Integration	S		12/26						
24	ONH Prog Prod & Unit C/O	F		1/11						
31	ONH Integration	S		1/14						
25	OTCH Prog Prod & Unit C/O	F		1/25						
	Previous FY-74 Milestones Completed						17	5	1	
						TOTALS	19	4	0	C
						FY-74 TOTALS	53	12	1	

ID: S = Start, F = Finish, P = Preliminary, D = Deliverable, E = External Deliverable, * = Completed early

MILESTONES MISSED (INCLUDE REASONS, EFFECT ON PROBLEM/PROJECT, REMEDIAL ACTION TAKEN, AND WHEN)

103

Chart REV A

SIGNATURE

DATE 10 December 1973

ONE REPORT - DETAIL

PROBLEM/PROJECT N424/OSIS

WEEK ENDING 7 December 1973

PROBLEM MANAGER, CODE 1130

PROGRAM MANAGER, CODE 1100

MILESTONE No.	MILESTONE IDENTIFICATION		RESPONSIBLE CODE	SCHEDULED	REVISED	ACTUAL	MADE	MISSED Resp Code	MISSED Other	CURRENT WEEK MISSED
105	APS 2.0 S/S Design Validation	S	1130	9/10		9/10	X			
106	APS 2.0 S/S Design Validation	D		11/23	12/12			X		
105B	3.0 Functional Analysis	S		10/1		10/1	X			
106B	3.0 Functional Analysis	D		11/9		11/9	X			
101C	3.0 Data Requirements	S		11/12		11/12	X			
102C	3.0 Data Requirements	D		12/14						
	Previous FY-74 Milestones completed						11	2	7	
						TOTALS	4	1	0	0
						FY-74 TOTALS	15	3	7	

D: S = Start, F = Finish, P = Preliminary, D = Deliverable, E = External Deliverable, * = Completed early

MILESTONES MISSED (INCLUDE REASONS, EFFECT ON PROBLEM/PROJECT, REMEDIAL ACTION TAKEN, AND WHEN)

Chart REV B

TURE

DATE 10 December 1973

TO: RESPONSIBLE CODE(S) AND THEIR RESPECTIVE DEPT HEAD(S)

NND-NELC-F-3600/1&3 (REV. 6-7

NE REPORT - DETAIL

PROBLEM/PROJECT N424/OSIS

WEEK ENDING 7 December 1973

ROBLEM MANAGER; CODE 1130

ROGRAM MANAGER, CODE 1100

No.	MILESTONE IDENTIFICATION		RESPON-SIBLE CODE	MILESTONE DATE SCHEDULED	REVISED	ACTUAL	CHECK ONE MADE	MISSED Resp Code	MISSED Other	CURRENT WEEK MISSED
)1	I/O Formats for 2.0 Test Progs	F	230	7/13		7/13	X			
)5	CA 2.0 S/S Test Plan (I)	S		9/17		*9/10	X			
)6	CA 2.0 S/S Test Plan (I)	D		9/28		*9/21	X			
)8	CA 2.0 S/S Test Proc & Data (II)	S		10/1		10/1	X			
)9	IMP 2.0 S/S Test Plan (I)	S		10/1		10/1	X			
0	COMM 2.0 S/S Test Plan (I)	S		10/1		10/1	X			
1	IMP 2.0 S/S Test Plan (I)	D		10/12		10/12	X			
2	COMM 2.0 S/S Test Plan (I)	D		10/12		10/12	X			
3	2.0 System Test Plan (I)	S		10/15		10/15	X			
4	IMP 2.0 S/S Test Proc & Data (II)	S		10/15		10/15	X			
)2	APS 2.0 S/S Test Plan (I)	S		10/15		10/15	X			
6	COMM 2.0 S/S Test Proc & Data (II)	S		10/15		10/15	X			
7	CA 2.0 S/S Test Proc & Data (II)	D		E 10/19	10/26	10/26	X			
8	2.0 System Test Plan (I)	D		10/26		*10/25	X			
)3	APS 2.0 S/S Test Plan (I)	D		10/26		*10/24	X			
9	2.0 System Test Proc & Data (II)	S		10/29		10/29	X			
)4	APS 2.0 S/S Test Proc & Data (II)	S		10/29		10/29	X			
'0	IMP 2.0 S/S Test Proc & Data (II)	D		E 11/2		11/6	X	X		
'3	CA 2.0 S/S Test Anal Rpt (III)	S		11/5	11/19	11/19	X			
'2	COMM 2.0 S/S Test Proc & Data (II)	D		E 11/9		*11/6	X			
'4	2.0 System Test Proc & Data (II)	D		E 11/16		11/16	X			
)7	APS 2.0 S/S Test Proc & Data (II)	D		E 11/16		11/16	X			
'5	IMP 2.0 S/S Test Anal Rpt (III)	S		11/19		11/19	X			
'7	CA 2.0 S/S Test Anal Rpt (III)	D		E 11/21	12/14					
'6	COMM 2.0 S/S Test Anal Rpt (III)	S		11/26		11/26	X			
'8	2.0 System Test Anal Rpt (III)	S		12/3		12/3	X			
5	APS 2.0 S/S Test Anal Rpt (III)	S		12/3	12/17					
'9	IMP 2.0 S/S Test Anal Rpt (III)	D		E 12/7	12/14					
0	COMM 2.0 S/S Test Anal Rpt (III)	D		E 12/14		*12/7	X			
1	2.0 System Test Anal Rpt (III)	D		E 12/21						
1	APS 2.0 S/S Test Anal Rpt (III)	D		E 12/21	1/4					
	Previous FY-74 Milestones completed						17	0	0	
):	S = Start F = Finish P = Preliminary D = Deliverable E = External Deliverable * = Completed early					TOTALS	26	1	0	0
	MILESTONES MISSED (INCLUDE REASONS, EFFECT ON PROBLEM/PROJECT, REMEDIAL ACTION TAKEN, AND WHEN)					FY-74 TOTALS	43	1	0	

: 217 date revised 10/15

. 228 & 221 dates revised 11/30/73.

Chart REV B

TURE

DATE 10 December 1973

TO: RESPONSIBLE CODE(S) AND THEIR RESPECTIVE DEPT HEAD(S)

NND NELC-1-3960/103 (REV. 7-73)

NE REPORT - DETAIL

PROBLEM/PROJECT N424/OSIS

WEEK ENDING 7 December 1973

ROBLEM MANAGER, CODE 1130

ROGRAM MANAGER, CODE 1100

MILESTONE No.	MILESTONE IDENTIFICATION		RESPON-SIBLE CODE	SCHEDULED	REVISED	ACTUAL	MADE	MISSED Dep Code	MISSED Other	
01	CA 1.7 Subsystem T&E	S	1130	7/9		7/9	X			
02	IMP 1.7 Subsystem T&E	S		7/9		7/9	X			
03	CA 1.7 Subsystem T&E	F		7/13		7/13	X			
04	IMP 1.7 Subsystem T&E	F		7/13		7/13	X			
05	1.7 System T&E	S		7/16		7/16	X			
06	COMM 1.7 Subsystem T&E	S		7/16		7/16	X			
07	1.7 System T&E	F		7/20		7/20	X			
08	COMM 1.7 Subsystem T&E	F		7/20		7/20	X			
09	APS 1.7 Subsystem T&E	S		8/13		8/13	X			
10	APS 1.7 Subsystem T&E	F		8/17		8/17	X			
13	CA 2.0 Subsystem T&E	S		10/29	11/5	11/12	X		X	
14	CA 2.0 Subsystem T&E	F		11/2	11/9	11/16	X		X	
15	IMP 2.0 Subsystem T&E	S		11/12		11/12	X			
17	IMP 2.0 Subsystem T&E	F		11/16		11/16	X			
16	COMM 2.0 Subsystem T&E	S		11/19		*11/12	X			
18	COMM 2.0 Subsystem T&E	F		11/21		*11/16	X			
19	2.0 System T&E	S		11/26		11/26	X			
11	APS 2.0 Subsystem T&E	S		11/26	12/13				X	
20	2.0 System T&E	F		11/30		11/30	X			
12	APS 2.0 Subsystem T&E	F		11/30	12/14				X	
08A	1.7 System Re-Test & Eval	S		8/6		8/6	X			
09A	COMM 1.7 Subsystem Re-Test & Eval	S		8/6		8/6	X			
10A	1.7 System Re-Test & Eval	F		8/10		8/10	X			
11A	COMM 1.7 Subsystem Re-Test & Eval	F		8/10		8/10	X			
	Previous FY-74 Milestones completed						4	0	0	
D:	S = Start F = Finish P = Preliminary D = Deliverable E = External Deliverable * = Completed early					TOTALS	22	0	4	0
						FY-74 TOTALS	26	0	4	

MILESTONES MISSED (INCLUDE REASONS, EFFECT ON PROBLEM/PROJECT, REMEDIAL ACTION TAKEN, AND WHEN)

113 & 114 dates revised 10/15

Chart REV C

SIGNATURE

DATE 10 December 1973

TO: RESPONSIBLE CODE (S) AND THEIR RESPECTIVE DEPT HEAD(S)

CONFIGURATION CONTROL

The following three pages are examples of forms used by the WWMCCS Project Office in tracking and controlling engineering changes within the project. Requiring a formal process such as this when engineering changes are performed maintains the necessary checks and balances on changes to the design. It allows the project manager to track the actual make-up of the equipment being developed.

ENGINEERING CHANGE ORDER

ECO No. (Same as ECR No.)	Date

1. ECO TITLE (Same as ECR)

2. IMPLEMENTATION SCHEDULE

	Start Date	Completion Date
Documentation	____________	____________
Program Development	____________	____________
Hardware Changes	____________	____________

System Version (IOC, etc.)	Phase (I or II)	Release Date

(Attach copy of revised bubble chart reflecting this change)

3. SYSTEM DESIGN SPECIFICATIONS

This paragraph will contain the system design specifications for each function requiring modification. This design will be prepared consistent with the OSIS performance and design specifications and development for the appropriate version. Functions will be specified separately as in the System Design Specifications to ease the future update of that document.

4. HARDWARE CHANGES

Hardware changes required will be noted with pertinent comments on installation date or other necessary information.

5. DOCUMENTATION CHANGES

(List the documents that will require update)

6. This change will be incorporated in the next revision of IWA(s):

Implementation authorized and directed: ____________________

J. C. Caldwell, Code 1130

NCD-NELC-4130/11 (6-73)

ENGINEERING CHANGE REQUEST

ECR No.	Date
1. Originator (NELC/NIPPSSA/User)	2. ECR Class (I/II)

3. Document(s) Affected/Title of Change:

4. Description of Change:

5. Reason for Change:

6. Estimated Impact: Phase I YES NO Phase II YES NO

(Explain "YES" response. Include revised schedule dates, etc.)

7. Estimated Effects on Performance/Design Specifications:

8. Rough Order of Magnitude Schedule and Cost Impact Statement:

Submitted: ______________________
(Task Leader Signature)

CONFIGURATION CHANGE CONTROL BOARD ACTION

Approved: ______________ *(Date)*	Disapproved: ______________ *(Date)*
Analysis Due: ______________ *(Date)*	From (Code):

Chairman: ______________________
(Signature)

FIELD ENGINEERING CHANGE REPORT

FECR No.	Date:
1. Originator:	
2. Description of Change:	
3. Reason for Change:	
4. Estimated Effects on Performance:	
Submitted: ____________________ (On-Site Team Leader)	
Forwarded: ____________________ (Task Leader)	Noted: ____________________ (Project Manager)

PROGRAM EVALUATION AND REVIEW TECHNIQUE (PERT)

PERT was developed for the Navy's Polaris missle project in 1958 and is credited with playing an important role in bringing missles into operation two years earlier than anticipated. PERT is basically a Critical Path Method of planning and controlling using a probability distribution to estimate most likely path lengths.

PERT is an excellent tool by which a project manager can:

- estimate the time at which each milestone in the project can be expected,
- predict slippages and estimate the effect of slippages,
- select the "critical path" of those activities which cannot be delayed without jeopardizing the entire project,
- force the project manager to draw a network and thereby think about his planning task,
- logically show how events relate.

PERT has faults, not the least of which is its complexity, but some variation of the critical path network can be used by every project manager as a tool to assist in planning for and controlling his project.

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